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and TOM IREDALE, F.R.Z.S.

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ICHTHYOLOGICAL NOTES AND ILLUSTRATIONS.

By G. P. Whitley.

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(Plates i.-ii. and text-figures.)

Some noteworthy fishes, examined in recent years, are described or illustrated in this paper, with notes on distribution, taxonomy, and other matters. As in my "Illustrations of some Australian Fishes", published in the Australian Zoologist, ix., December, 1940, I have not repeated such references to literature as can be found in McCulloch's "Check-List" (Australian Museum Memoir, v., 1929).

I am indebted to Dr. H. Thompson, of the C.S.I.R. Marine Biological Laboratory, Cronulla, New South Wales; to Messrs. H. Longman and T. C. Marshall, of the Queensland Museum, Brisbane; and to Mr. K. Salter, Curator of the Macleay Museum, University of Sydney, for placing rare and valuable specimens at my disposal. Mr. G. C. Clutton, of the Australian Museum, took the photographs.

Some of the fishes mentioned hereunder have potential economic importance and correct classification is a first step towards systematic knowledge of them. A new Ophidiid from the Great Australian Bight may prove a good food-fish in the future. Several remarkable larval or young fishes are recorded from Australia for the first time, and the juvenile stages of morwongs and trumpeter discussed. A few notes made in overseas museums before the war have been included.

Family Clupeidae.

Escualosa abbreviata (Cuv. & Val., 1847).

I was unable to trace the type of *Harengula abbreviata* Cuv. & Val., 1847, in the Museum National d'Histoire Naturelle, Paris, where the only specimen so-called was "acquis en échange du Musée Australien de Sidney, 21 Juin, 1866. No. 14 = 4180". This was the same species as *Kowala castelnaui* Ogilby, 1897, from Sydney, whose name is obviously a synonym of *abbreviata* which belongs to my genus *Escualosa*, 1940.

Genus Clupalosa Bleeker, 1849.

Clupalosa bulan Bleeker, 1849.

(Fig. 1.)

Clupalosa bulan Bleeker, Verh. Batav. Genootsch., xxii., 1849, Ichth. Madura, p. 12. Madura, East Indies. *Id.* Bleeker, *ibid.*, xxiii., 1850, p. 11, and xxiv., 1852, p. 30.

Clupea (*Harengula*) *bulan* Bleeker, Atlas. Ichth., vi., 1872, p. 110, pl. cclxvi., fig. 5. *Id.* Weber and Beaufort, Fish. Indo-Austr. Arch., ii., 1913, pp. 69 and 73.

Harengula bulan Paradice and Whitley, Mem. Qld. Mus., ix., 1, 1927, pp. 79 and 97 (Darwin).

Here figured from the young specimen, 34 mm. in standard length,

recorded from Darwin in 1927. Austr. Mus. Regd. No. IA.1,527. It has the following characters:—D.i., 17; A.19; Sc. 37; Tr., 12 to 13. Twelve predorsal scales. Adipose eyelids narrow. Mouth small, upper jaw notched at symphysis. Rudimentary teeth on palate. Venules on cheeks and shoulders. Depth one-third standard length. Scales numerous, without transverse ridges. Dorsal origin nearer snout than tail. Scaly sheaths to dorsal and anal fins. Margins of fins rounded. Pectorals long and pointed. Sixteen plus ten ventral scutes.

Coloration plain yellowish in formalin, some large dark chromatophores on snout, along dorsal base, median line of back, and looping upper half of caudal peduncle; fins infuscated.

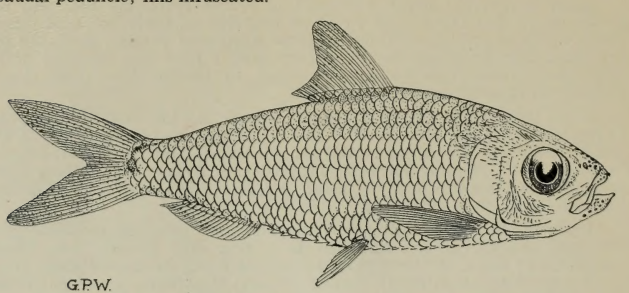

Fig. 1. Herring, *Clupalosa bulan*. Young from Darwin, N.T.

Family ENGRAULIDAE.

Genus THRISSINA Jordan and Seale, 1925.

Thrissina Jordan and Seale, Copeia, 1925, p. 30; Bull. Mus. Comp. Zool., lxvii., 11, 1926, p. 375. Orthotype, "*Clupea boelama* Forskal" [Non-binomial vernacular name = *Clupea baelama* Bloch and Schneider, Syst. Ichth., 1801, p. 429] = *Thrissina baelama*. *Id.* Hardenberg, Nat. Tijdschr. Ned. Ind., xciii., 2, 1933, p. 243 (regarded as = *Thrissa*, but that genus has much longer maxillary).

Maxillary not extending to gill-opening. Lower jaw included. Teeth even, no canines. Gill-rakers 23 or 24 on lower branch of first gill-arch. Scales firm. No silvery lateral stripe. Vertebrae 39 to 42. Ventral scutes weak, almost hidden by scales, none before pectorals in the Red Sea genotype, but there are five in the Queensland species, *aestuaria*. No enlarged alar scales on caudal. Caudal peduncle short below. Dorsal fin preceded by a spine. Anal base behind level of dorsal. Anal rays 31 to 34. Uppermost pectoral ray pointed but not produced, reaching ventral origin.

Close to *Scutengraulis* but has weaker ventral scutes, fewer vertebrae and anal rays, and shorter anal base in relation to standard length.

THRISSINA AESTUARIA (Ogilby, 1910).

(Fig. 2.)

Anchovia aestuaria Ogilby, Proc. Roy. Soc. Qld., xxiii., November, 1910, p. 4.

Brisbane River, Queensland. Holotype in Amat. Fisherm. Assoc. Qld. coll., Brisbane; co-types in Queensland and Australian Museums. *Id.* Ogilby, Fish. Rept. Qld. 1910-1911 (1912), append.

Engraulis nasutus De Vis, Proc. Linn. Soc. N.S. Wales, vii., 1882, p. 319. (One of De Vis' specimens in Aust. Mus. examined.) *Id.* Saville-Kent, Great Barrier Reef, 1893, pp. 301 and 370. (Brisbane records.) Not *Engraulis nasutus* Castelnau, 1878, from the Norman River, North Queensland.

Here illustrated from one of Ogilby's co-types (regd. No. I.9498) in The Australian Museum, and measuring 122 mm. in standard length. It has five scutes before the pectoral base and eight behind the ventral fin, the intermediate ones obscured by scales.

Locality.—Brisbane River, Queensland.

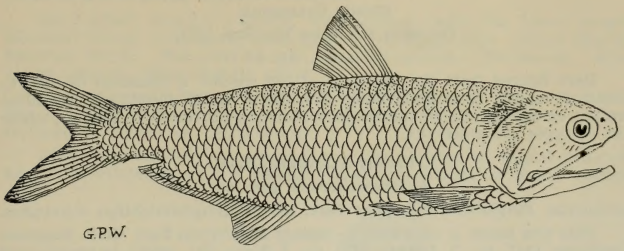

Fig. 2. Anchovy, *Thrissina aestuaria*. Co-type, Brisbane River, Qld.

Genus SCUTENGRAULIS Jordan and Seale, 1925.

SCUTENGRAULIS SCRATCHLEYI (Ramsay and Ogilby, 1886).

(Fig. 3.)

Engraulis scratchleyi Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i., May 25, 1886, p. 18. Strickland River, New Guinea. Holotype (No. B.9951) in Australian Museum. *Id.* Weber and Beaufort, Fish. Indo-Austr. Arch., ii., 1913, p. 34. *Id.* Weber, Nova Guinea, ix., 1913, pp. 517, 604 & 607 (Lorentz River). *Id.* Regan, Trans. Zool. Soc. London, xx., 2, 1914, p. 276 (Mimika River, Dutch N.G.). *Id.* Fowler, Mem. Bish. Mus., x., 1928, p. 32.

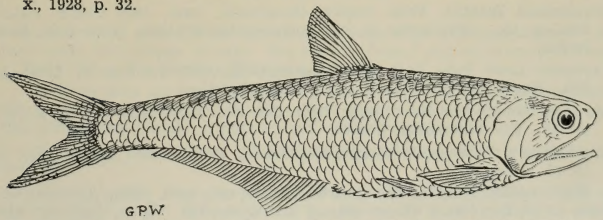

Fig. 3. Anchovy, *Scutengraulis scratchleyi*. Holotype, Strickland River, New Guinea.

Anchovia scratchleyi Jordan and Seale, Bull. U.S. Bur. Fish., xxv., 1905 (1906), p. 188.

Thrissocles scratchleyi Fowler, Mem. Bish. Mus., xi., 1934, p. 387, and Bull. U.S. Nat. Mus., 100, xiii., 1940, p. 670.

This species has not hitherto been figured, so I supply a drawing of Ramsay and Ogilby's holotype. I have also seen a New Guinea specimen in the Queensland Museum.

In Jordan and Seale's "Review of the Engraulidae" (Bull. Mus. Comp. Zool. Harvard, lxvii., 11, May, 1926) this species enters the subfamily Stolephorinae and genus *Scutengraulis*, having ventral scutes continuous from throat to vent, and the dorsal fin preceded by a short free spine.

Family Galaxiidae.

Galaxias bongbong Macleay, 1881.

(Plate i., fig. 4.)

Here figured from the lectotype of the species, a specimen 68 mm. in standard length, from Bong Bong, New South Wales, kindly lent for illustration by the Curator of the Macleay Museum, University of Sydney, where the co-types are preserved.

Family Alepocephalidae.

Binghamichthys, *gen. nov.*

Orthotype, *Binghamia microphos* Parr, 1937 = *Binghamichthys microphos.*

This new name is necessary to replace *Binghamia* Parr (Bull. Bingham Oceanogr. Coll., iii., 7, August, 1937, pp. 2, 7 and 22), which is preoccupied by *Binghamia* Tutt, Brit. Butterflies, iii., 1908, pp. 41 and 43, if not by *Binghami* Brown, 1827, in Mollusca.

Family Astronesthidae.

Stomiatoid fishes with adipose dorsal fin present and no scales on body. Dorsal fin inserted behind level of vent, its base in advance of that of anal fin. Body elongate, naked.

Genus Astronesthes Richardson, 1845.

Astronesthes Richardson, Zool. Voy. Sulphur, i., Fish, 1845, p. 97. Haplotype, *A. nigra* Richardson, from China (?).

Stomianodon Bleeker, Verh. Batav. Genootsch., xxii., 1849, Ichth. Faun. Bali, p. 10. Haplotype, *S. chrysophekadion* Bleeker, from Bali, East Indies.

Phaenodon Lowe, Proc. Zool. Soc. London, xviii,, 1850 (January 24, 1852), p. 250. Haplotype, *P. ringens* Lowe, from Madeira.

Phaenodus Goode and Bean, Spec. Bull. U.S. Nat. Mus., 1895, Ocean. Ichth., p. 105. For *Phaenodon* Lowe.

"Stomiatella C." Roule and Angel, Res. Camp. Sci. Monaco, lxxix., 1930, p. 16, pl. i., figs. 8-9.

The interesting larval fish described below may be a young *Astronesthes* whose adult form and whose species are unknown. It is, however, not certain that it belongs to this genus and since Roule and Angel's larval name *Stomiatella* has been applied in part to other genera by Beebe and

Crane (Zoologica, xxiv., 2, July 31, 1939, pp. 67, 74 and 75), it seems advisable to provide a distinctive new subgeneric name for the Australian fish. I therefore propose *Warreenula*, subg. nov. with the new species *lupina* as orthotype. It differs markedly from adult *Astronesthes* in characters of dentition, alimentary canal, lack of ventral fins, light-organs and barbel, but how far these differences may be due to metamorphosis can only be determined when larger specimens can be obtained. It agrees with no species in Regan and Trewavas' recent revision (Dana Rept., v., 1929).

ASTRONESTHES (WARREENULA) LUPINA, *subg. et sp. nov.*

(Fig. 5.)

D., 14; A., 13; P., ?; V.O.; C., 18. About 50 myotomes. Size small, general facies as shown in the figure.

Head about one-fifth length, with gaping jaws, the lower longer. Maxillary broad, with about nine larval teeth along edge. Snout slightly excavate above. Eye oblique, oval, not pedunculate. No barbel. Gill-rakers present. Nape slightly tumid.

Body elongate, with six large black pigment-spots on sides. No lateral line. Alimentary canal with long free posterior portion. Intestine not yet enclosed by myomeres. No yolk-sac.

Dorsal fin fan-like, on elevated base, in advance of caudal peduncle and with finfold before and behind. Anal base similar to dorsal, entirely

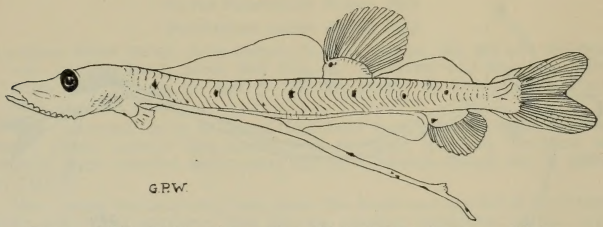

Fig. 5. Little Wolf, *Astronesthes* (*Warreenula*) *lupina*. Holotype, New South Wales.

behind level of dorsal, with finfold anteriorly only. Caudal bilobed. Pectoral pads with fringe of rays. No ventral fins; I cannot trace a rudiment unless it be under the fourth pigment spot.

Whitish with six black spots along sides, more widely spaced anteriorly; other groups of chromatophores before dorsal and anal bases and along free alimentary canal. A pair of spots between pectorals.

Less than 1 inch long (20 mm. in standard length or nearly 24 mm. over all).

Locality.—Off Port Stephens, New South Wales; M.V. "Warreen" station, 55/38 = 32° 40'S. x 152° 22'E. Netted 27/9/1938. Type in C.S.I.R. Marine Biological Laboratory, Cronulla, New South Wales.

New record (family, genus and species) for Australia.

Family IDIACANTHIDAE.

Genus STYLOPHTHALMUS Brauer, 1902.

STYLOPHTHALMUS PARADOXUS Brauer, 1902.

(Fig. 6.)

? *Idiacanthus fasciola* Peters, Monatsb. K. Akad. Wiss. Berlin, 1876 (1877), p. 847. Northern Australia and New Guinea.

Stylophthalmus paradoxus Brauer, Zool. Anzeiger, xxv., 1902, p. 298. Indian Ocean, Antarctic Seas, and south of Capetown. *Id.* Brauer, Verh. Deutsch. Zool. Gesellsch., xii., 1902, p. 56, figs. *Id.* Chun, Tiefen Weltmeeres, 1903, p. 577 and fig. *Id.* Brauer, Wiss. Ergeb. Deutsch. Tiefsee Exped., xv., 1, 1906, p. 66, pl. v., *et ibid.*, xv., 2, 1908, p. 178 and anat. figs. And of later authors.

This curious genus and species was originally described by Brauer from south of Capetown, Antarctic Seas, and the Indian Ocean. In his "Valdivia" report (*loc. cit.*, 1906), he gave figures and an extended description, based on 35 specimens, many of them additional to the original series, and recorded fresh localities. It is probable that more than one species is confused under the specific name, but we may follow Chun (1903) who indicated that the form shown in Brauer's "Valdivia", pl. v., fig. 6, came from the equatorial Indian Ocean, so that specimen may be regarded as lectotype and that locality as typical. The type-specimens are in the Berlin Museum, where I saw them in November, 1937.

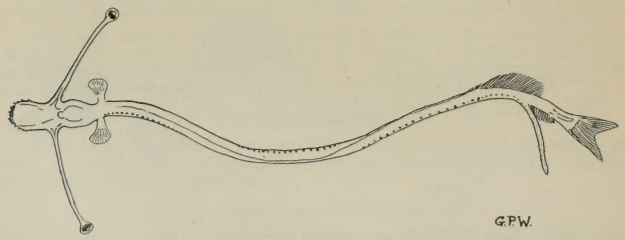

Fig. 6. Stalk-eyed Marvel, *Stylophthalmus paradoxus*. New South Wales.

Since Brauer's time, *Stylophthalmus* has been demonstrated to be a larval form common to several different kinds of deep-sea fishes, but the name may be retained until the exact identity of the typical adult can be determined. In this connection, see especially Beebe, Zoologica, xvi., 4, 1934, pp. 149-241, figs. 47-81.

I was surprised to find one of these larvae in a collection of surface fishes from New South Wales made by the M.V. "Warreen". It seems best to use Brauer's name for this until further investigation shows whether it be true *paradoxus* or not.

The Australian specimen may be thus described; because of its small size it is impossible to give exact fin-counts, etc.

Head depressed, "duck-billed", lower jaw longer, the mouth with spaced

teeth along margin. Eyes at end of long stalks. Brain visible through skull.

Body, very elongate, compressed, about a millimetre deep. A single row of spaced melanophores along each side, about 64 to origin of dorsal fin and 71 to base of vent, where the alimentary canal proceeds free of the body for some distance, reaching caudal, but less than length of eye-stalks.

Dorsal fin preceded by a fin-fold, its origin in posterior fifth of body; there appear to be 30 main rays with incipient rays anteriorly and posteriorly. Anal originating below hinder part of dorsal, with 17 rays. Pectorals just behind head with fleshy bases. No ventrals. Caudal forked.

It differs in proportions and fin-counts from Brauer's pl. v., fig. 6, which is more like my specimen than his other figures.

Translucent whitish or yellowish, the eyes very dark grey. Rows of blackish spots along sides for most of length. Free portion of alimentary canal speckled.

Length about 1½ inches or 40 mm.

Locality.—Sixteen miles E.N.E. of Point Perpendicular, New South Wales. "Warreen" station, 142/39; net 200 horizontal; 30/5/1939. C.S.I.R. collection, Marine Biological Laboratory, Cronulla, New South Wales.

New record for New South Wales and for Australia, too, unless it be the young of *Idiacanthus fasciola* Peters, 1877, a tropical species.

Family Plotosidae.

Genus Porochilus Weber, 1913.

Porochilus obbesi Weber, 1913.

Porochilus obbesi Weber, Nova Guinea, ix. (4), 1913, pp. 523, 604 and 607, figs. 4-5. Lorentz River, south New Guinea. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip., ii., 1913, p. 235, figs. 94-95. *Id.* Fowler, Mem. Bish. Mus., x., 1928, p. 63.

Two specimens, up to 2½ inches long, from Yam Creek (nine miles from Brock's Creek, railway line south from Darwin), Northern Territory of Australia, were collected many years ago by A. Morton (Regd. Nos. A.4823a and I.B.618).

New record for Australia, and, since the genus and species is otherwise known only from southern New Guinea, another indication of the uniformity of the Leichhardtian fluvifaunula.

Neosilurus mortoni, *sp. nov.*

(Fig. 7.)

Head (35 mm.), 4.8; depth (32), 5.3 in standard length (170). Preanal length, 65 mm. Predorsal length, 49 mm. Caudal fin, 25 mm. Eye (8), less than snout (13) and interorbital (10) and 4.3 in head. Nasal barbel (13 mm.) equal to the snout, which is broader than long. Maxillary barbel (18) reaching to behind eye. Mandibulary barbel (21) reaching to beyond gill-opening below, not reaching pectoral base. Mental barbel (12.5) shortest of all. Lips not markedly plicate. Upper jaw the longer. Width of mouth subequal to interorbital. Brown, blunt, peg-like teeth in jaws, and a group of spaced molariform teeth on vomer; crowns of some mandibular teeth rounded. Anterior nostril on each side of head above upper jaw; opening laterally. Orbit with free margin. Opercle with radiating striae. Fifteen gill-rakers on lower branchial arch, their inner basal mem-

brane with knob-like processes. Gill-membranes united, free of isthmus.

Body very compressed, lanceolate. Skin smooth, without filaments. Lateral line almost straight. An anal papilla, but no dendritic appendage. An axillary pore present. Dorsal spine (14 mm.) pungent, with small serrations behind, granular anteriorly. Distal portions of dorsal and pectoral spines cartilaginous, forming a kind of rayed membrane between osseous tip of spines and first rays of fins. Four branched dorsal rays. Dorsal base behind level of pectoral base. Height of first dorsal fin not

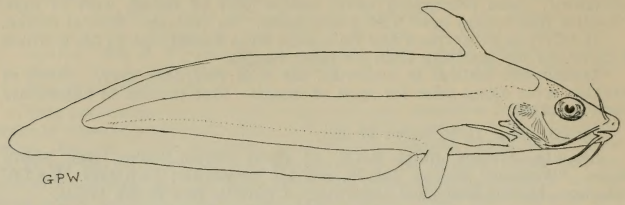

Fig. 7. Morton's Tandan, *Neosilurus mortoni*. Holotype, Yam Creek, Northern Territory.

nearly as much as depth of body below it. Procurrent (caudodorsal) fin very low, not nearly reaching half-way along fish, and well behind level of ventrals. Preanal length 1/3rd of total. Anal fin long and high, with about 80 rays, the last connected with caudal fin. Pectorals with a serrated spine and seven rays. Ventrals with twelve rays. Caudal with 19 rays, asymmetrical, its axis sloping obliquely downwards, its margin convex.

Colour, after long preservation in alcohol, brownish, with numerous punctulations on head and fins. May have been greyish or silvery in life. Barbels and teeth dark brown.

Length $7\frac{3}{4}$ inches overall. Distinguished from its allies by its finformulae, gill-rakers, barbels, proportions, and reduced caudodorsal procurrent fin.

Locality.—Yam Creek (nine miles from Brock's Creek, railway line south from Darwin), Northern Territory of Australia; coll. A. Morton, 1879, Austr. Mus., Regd. No. A.4,824.

This species is named in honour of Alexander Morton (1855 ?—1907) who collected specimens for The Australian Museum in many parts of Australia, the South Sea Islands, New Guinea and Lord Howe Island.

Family TACHYSURIDAE.

COCHLEFELIS, *gen. nov.*

Orthotype, *Arius spatula* Ramsay and Ogilby, 1886.

Head very long and depressed, wider than deep, protected above by an exposed, granulated casque. Top of the spatulate snout membranous. Fontanelle narrow posteriorly. Nostrils approximate, the posterior valvular; no nasal barbels. Eyes small, adnate to head, behind level of mouth. No preorbital cavity. Maxillary, mandibulary, and mental barbels attenuate, fairly elongate. Mouth capacious, wider than interorbital. Lips thick, the upper produced posteriorly in a lobe. Teeth villiform, in transverse, pluriserial bands on jaws and palatines. No naked symphysial area in upper

jaw; no backward strip of palatine teeth; no granuliform teeth. Teeth of upper jaw overhanging lower jaw. Palatine teeth in small inner oval patches contiguous to diverging outer patches.

Gill-openings very wide, gill-membranes united across isthmus, 12 gill-rakers on lower limb of first branchial arch. Last branchiostegal ray not expanded. Body elongate. Axillary pore minute. Vent inconspicuous.

Dorsal buckler moderate, granulated, saddleshaped, in close contact with nuchal shield. Dorsal spine strong, subequal to postorbital, weakly serrated, the serrae directed downwards; none of the fin-rays produced. Origin of dorsal about mid-way between pectorals and ventrals. Adipose fin large, mostly over anal, but its anterior margin in advance of level of anal origin, its base longer than that of dorsal fin.

Base of anal less than head. Pectoral spine weakly serrated, shorter than dorsal spine, the fin long. Ventrals with narrow bases. Caudal strongly forked, free of anal.

Freshwater, New Guinea.

Cochlefelis differs from *Arius* Cuv. & Val., 1840 (tautotype, *Pimelodus arius* Hamilton-Buchanan, 1822, from India) in having a very differently shaped head and skull, the eyes being very small instead of very large; the dorsal spine has no long, soft prolongation and there are fewer anal rays than in typical *Arius*. The new genus differs from other Tachysurid genera in the combination of characters defined above.

COCHLEFELIS SPATULA (Ramsay and Ogilby, 1886).

Arius spatula Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i., May 25, 1886, p. 15. Strickland River, New Guinea. Holotype in Austr. Mus *Id.* Weber, Nova Guinea, ix., 1913, pp. 538, 539 and 608. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip., ii., 1913, p. 296.

Netuma spatula Jordan and Seale, Bull. U.S. Bur. Fish., xxv., 1905 (December 15, 1906), p. 191.

Arius nudidens Weber, Nova Guinea, ix., 4, 1913, pp. 538, 604 and 608, fig. 15. Lorentz River, New Guinea. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip., ii., 1913, p. 294, fig. 120. *Id.* Hardenberg, Treubia, xv., 4, 1936, p. 369 (Digul River).

Tachysurus nudidens and *spatula* Fowler, Mem. Bish. Mus., x., 1928, p. 62.

On comparing the holotype of *spatula* with descriptions and figures of *nudidens* it is apparent that these two nominal species are synonymous. The slight differences in fin-counts and proportions of eyes and occipital shields are either due to different methods of measuring or may be accounted for by variation or changes with growth.

Range.—Strickland, Digul and Lorentz Rivers, southern New Guinea (freshwater).

TACHYSURUS (PARARIUS) BERNEYI, *sp. nov.*

(Fig. 8, No. 5.)

D.i., 7; A., 15; P.i., 10; V., 6; C., 15.

Head (38 mm.) 4, depth (30) 5 in length to end of middle caudal rays (152). Width of head (27) greater than its height. Eye, 7.5 mm.; interorbital, 18; snout, 13; width of mouth-opening, 16; maxillary barbel, 61; mandibulary barbel, 40; mental barbel, 22.5; predorsal length, 54; inter-

dorsal, 40; pungent dorsal spine, 30; or with its extension, 43.5; pectoral spine, 32; depth of caudal peduncle, 10.5.

Head wedge-shaped. Eye with free lid. Interorbital broad and flat. Mouth well before level of eye. Premaxillary teeth villiform, pluriserial, in a continuous band. Mandibular band divided at symphysis. Vomerine and palatine patches of villiform teeth in contiguous rounded patches, without backward extensions.

Maxillary barbel reaching to below posterior dorsal rays. Mandibulary barbel reaching to inner pectoral rays. Mental barbels reaching beyond gill-opening below head. Gill-membranes united across isthmus at oblique angle. 10 gill-rakers on lower limb of first gill-arch.

Cranial and occipital shields with small rounded granules, mostly embraced by smooth skin on top of head. Occipital shield longer than wide, subtriangular and with median ridge. Predorsal shield small, crescentic, hidden. Fontanelle lanceolate, longer than eye, tapering posteriorly.

Body rather robust. Lateral line obsolete before level of dorsal fin and without anterior granulation. Axillary pore conspicuous.

Dorsal spine weakly serrated with long cartilaginous extension. Adipose fin large, entirely over anal. Anal length subequal to its height and about half head. Pectoral spine serrated posteriorly, the fin pointed and nearly as long as head. Ventrals not reaching anal, their length equals interorbital. Caudal forked, the upper lobe longer.

Greyish above, yellowish to whitish below, tips of fins somewhat dusky. Eye bluish.

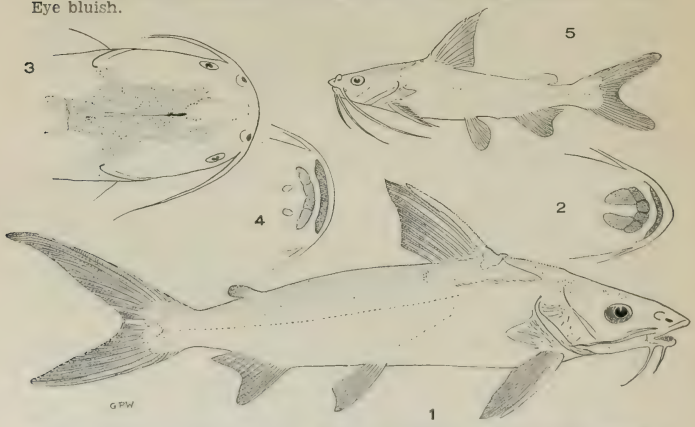

Fig. 8. Salmon Catfishes; No. 1, *Netuma thalassina jacksonensis*, holotype of subspecies, from Sydney; 2, palatal teeth of same; 3, *Tachysurus (Pararius) godfreyi*, holotype from Darwin; 4, palatal teeth of same; 5, *Tachysurus (Pararius) berneyi*, holotype from Flinders River, Queensland. (Block by courtesy of the Trustees of The Australian Museum).

Described and figured from the holotype of the species, a specimen 7 inches overall. Austr. Mus., Regd. No. I.13,076.

Locality.—Holotype and paratype (I.13,075) from pools of the Flinders River, near Hughenden and Richmond, Queensland (freshwater). Twelve smaller paratypes from Mapoon, western Cape York, Queensland, so the species is evidently estuarine and fluviatile.

Named in honour of Mr. Frederick L. Berney, the well-known ornithologist, who made a valuable collection of fishes in Central Queensland nearly thirty years ago.

This new species is allied to *T.* (*P.*) *proximus* (Ogilby, 1898), of which I recently figured a Broome specimen (Austr. Zool., ix., 4, December, 1940, p. 409, fig. 16), but differs in having much longer barbels, larger adipose dorsal fin, head wider than high, more elongate fins and different body-proportions. Other allied species are *leptaspis* Bleeker, 1863, *graeffei* Kner and Steindachner, 1867, *australis* Gunther, 1867, and, perhaps, *Neoarius curtisii*, Castelnau, 1878, from all of which *berneyi* differs in similar respects.

TACHYSURUS (PARARIUS) GODFREYI, *sp. nov.*

(Fig. 8, Nos. 3 & 4.)

D.i., 7; A., 16; P.i., 9; V., 6; C., 15.

Head (89 mm.) nearly 3.6, depth (41) 7.8 in length to end of middle caudal rays (320). Width of head (70) much greater than its height (about 39). Eye, 12 mm.; interorbital, 46; snout, 23; width of mouth-opening, 41; maxillary barbel, 78; mandibulary barbel, 52; mental barbel, 30; predorsal length, 114; interdorsal, 88; pectoral spine, 57; dorsal spine, 49; depth of caudal peduncle, 20.

Eye small, elliptical, with free lid. Interorbital very broad and flat. Mouth a little before level of eye. All teeth villiform, none granular. Premaxillary teeth in continuous band. Vomerine teeth in contiguous patches, followed by an isolated small patch of palatine teeth behind. A symphysial gap in mandibular teeth.

Posterior nostrils valvular. Maxillary barbel reaching pectoral base. Mandibulary barbels reaching gill-openings below. Mental barbels short. Gill-membranes united across isthmus at oblique angle. A few short gill-rakers. Opercles smooth. Suture between operculum and interoperculum pronounced. Humeral process small, triangular, granulated. Cranial and nuchal shields coarsely granulated. Occipital process wider than long, with a median keel. Predorsal shield large, suboblong. Fontanelle moderate. Occipital groove shallow. Branchiostegal membrane ragged.

Body entirely smooth, depressed anteriorly, compressed posteriorly; back fairly level. Lateral line feebly developed on sides behind dorsal fin and without lower fork on tail. Axillary pore minute. Vent nearer ventral than anal base. Dorsal spine serrated near tip anteriorly (but not posteriorly) and with two rows of granules near its origin which merge into one row to the serrations. Adipose dorsal fin large, over anal fin, its base more than its height and 3 in interdorsal space. Anal base and height half length of head; anal border emarginate. Ventrals less than interorbital, shorter than dorsal and not quite reaching anal. Pectoral spine serrated behind. Caudal forked, upper lobe longer, but less than head. Dark greyish above, silvery below, fins yellowish, dorsals and pectorals infuscated grey.

Described and figured from the holotype, a specimen 320 mm. or 13 inches long, from Port Darwin, Northern Territory; coll. Hugh W. Christie and C. F. Godfrey, 1902 (Austr. Mus., Regd. No. I.5,270).

From *Pararius australis, proximus* and *graeffei*, the novelty differs in the shape of the cranial and predorsal shields, also in proportions and dentition. *Hexanematichthys leptaspis* or *leptocassis* Bleeker (Atl. Ichth., ii., 1862, p. 27, pl. lxv., fig. 2) from S.W. New Guinea similarly differs and has more anal rays.

Arius latirostris Macleay, is another *Pararius* which lacks the isolated palatine tooth-patches and has a smaller predorsal shield, in these respects being like *berneyi* from Queensland.

Genus Netuma Bleeker, 1858.

Netuma thalassina jacksonensis, *subsp. nov.*

(Fig. 8, Nos. 1 & 2.)

D.i., 7; A., 14; P.i., 11; V., 6; C., 15.

Head (84 mm.) 3.6, depth (60) about 5 in length to end of middle caudal rays (305). Width of head at opercles (55) subequal to its height. Eye, 15 mm.; interorbital, 38; snout, 31; width of mouth-opening, 35; maxillary barbel, 45; mandibulary barbel, 28; mental barbel, 18; predorsal length, 115; interdorsal, 92; pectoral spine, 50; depth of caudal peduncle, 20.

Eye with free lid, except below and behind, where it is shelving. Interorbital broad and flat. Mouth well before level of eye. All teeth villiform, none granular. Premaxillary teeth in continuous band, sloping upwards and backwards. Mandibular series with a gap at the symphysis. Vomerine and palatine teeth in three contiguous patches on each side as figured. Vomerine teeth extending some distance backwards.

None of the barbels reaching gill-opening. Gill-membranes united across isthmus at oblique angle. Eight short gill-rakers on lower half of first branchial arch. Opercles with few venules or striae. Suture between operculum and interoperculum pronounced. Humeral process broad, with waved radiating ridges. Cranial and nuchal shields weakly granulated, covered by skin of head. Occipital process longer than wide, with a median keel. Predorsal shield with lateral and backward-extending wings. Fontanelle inconspicuous, lanceolate. Occipital groove fairly deep and long.

Body fairly compressed and elongated; back arched. Lateral line obsolete below dorsal fin and forked on tail, without anterior granulation. A small axillary slit. Predorsal length less than one-third length to end of middle caudal rays. Vent nearer ventral than anal base.

Dorsal spine serrated before and behind with two rows of granules towards its origin, longer than maxillary barbel. Adipose dorsal fin rather long, one-fifth of interdorsal space and situated over middle anal rays.

Anal base subequal to its height and less than half head; anal border concave.

Ventrals truncate, equal to interorbital, shorter than dorsal, and not reaching anal. Pectoral spine similar to dorsal. Caudal fin damaged and colour faded in the spirit specimen.

Described and figured from the holotype of the subspecies, a specimen one foot long to end of middle caudal rays (Austr. Mus., Regd. No. I.10,095), from Port Jackson, New South Wales. It is apparently a rare visitor to the

Sydney district, from which the Museum has a second Port Jackson specimen, 2 ft. 3 in. in length. This paratype agrees with the described example in general features, but has head 4 in length and ventral fins long, about equal to width of head; the upper caudal lobe is the longer but is less than length of head; these differences are probably sexual.

The Port Jackson type differs from true *Bagrus thalassinus* Rüppell (Neue Wirbelth. Abyssin., Fische, 1837, p. 75, pl. xx., fig. 2) from Massowah, Eritrea, in having the adipose fin farther forward in relation to posterior anal rays, and different proportions of depth in length, snout in head, etc., but otherwise agrees very closely.

Family LEPTOCEPHALIDAE.

POUTAWA HABENATA LONGICAUDA (Ramsay and Ogilby, 1888).

(Fig. 9.)

A young specimen, about 74 mm. long, and considerably more advanced than the *leptocephalus* figured by me (Rec. Austr. Mus., xx., 1937, p. 8, fig. 3) has the following characters:—

Upper jaw longer, snout acute; lower jaw very sharply pointed. Mouth reaching to below eye. Dentition not yet developed. No long larval teeth. Eye higher than long and much longer than interorbital width. Snout about $3\frac{1}{2}$ in head which is about $13\frac{1}{2}$ in length. Nostrils before eyes.

Body very elongate and compressed, its greatest height (about middle of trunk) being less than head, tapering to acutely pointed tail-tip. About 113 myotomes, of which 30 or more are predorsal, and about 50 preanal.

Small pectoral fins present behind gill-slits. Dorsal originating in anterior, anal in posterior half of fish, both fins with many rays well developed. A broad, rayed caudal fin surrounds tail-tip.

General colour pale horn, the eye blue and silvery. A double row of black chromatophores along belly to vent: anteriorly they are separated and the pairs easily distinguished (60 or so to below dorsal origin), but posteriorly the chromatophores coalesce into stripes which diverge and then converge at the anus. A single row of chromatophores along anal base, some fainter ones along dorsal base and middle of sides and tail. A V-shaped group of chromatophores, pointing forwards, on throat before pectorals.

Fig. 9. Little Conger, *Poutawa habenata longicauda*. Young, New South Wales.

Described and figured from a young example, about 74 mm. or nearly 3 inches long. Austr. Mus., Regd. No. IB.547.

Locality.—Jervis Bay, New South Wales; attracted to submarine light aboard the "Warreen", 7th October, 1940. Collected by Dr. D. L. Serventy, C.S.I.R. Marine Biological Laboratory, Cronulla.

Subfamily SCALANAGOINAE.

Genus SCALANAGO Whitley, 1935.

SCALANAGO LATERALIS Whitley, 1935.

Scalanago lateralis Whitley, Rec. Austr. Mus., xix., September 19, 1935, p. 218, fig. 2. Bondi, N.S. Wales. Types in Austr. Mus.

Mr. A. J. Fraser has presented a large specimen of this species from Middleton Beach, Albany, Western Australia, where it was dug out of sand on November 11, 1939. This greatly extends the range of the genus and species, hitherto known only from near Sydney, New South Wales. The specimen is 225 mm. or about 9 inches long and agrees in detail with the eastern ones, except that it is of record size and has the following characters. Maxillary hardly reaching to below middle of eye. Few, if any, teeth external to mouth-opening. Lateral line with about 119 cross-canals and with many pores over their courses; on most of the head the pores are more conspicuous than the underlying canals. Pectoral fins shorter than upper jaw, the margin more rounded. Head, 34 mm.; eye, 8; snout to vent, 79; snout to dorsal origin, 38. Colour pale pearly grey to horn yellowish. Unpaired fins with dark grey margins and thin pale borders. Snout gelatinous yellowish. Eye pale bluish.

New record for Western Australia. Probably the above differences may all be accounted for by growth, otherwise the western form will require a new subspecific name. Further specimens would be welcome, and it would be interesting to know if the species occurs in intermediate localities.

Family OPHICHTHIIDAE.

Genus OPHICHTHUS Thunberg, 1789, *sensu lato*.

OPHICHTHUS DERBYENSIS, *sp. nov.*

(Fig. 10.)

Head (14 mm.) 18, depth (4) 64.5 in total length (258). Predorsal length, 22 mm.; preanal length, 81. Eye (1) 2.75 in snout (2.75) and slightly less than interorbital (1.1). Length of lower jaw nearly 4 mm.; of gape, 4.25; pectoral, 3.5 mm.

Fig. 10. Snake Eel, *Ophichthus derbyensis*. Holotype, Derby, W. Australia. Also dentition and head enlarged.

Head acutely pointed, upper jaw much longer than lower. A fleshy tip to lower jaws; no cirrhi. Eye small, adnate to skin. Anterior nostrils large and flap-like, in upper lip anteriorly; posterior nostrils not far behind, less conspicuous. Two or three teeth on intermaxillary, the largest a depressible fang. All teeth conic, recurved; none granuliform. A single row of vomerine canines with a group of enlarged teeth anteriorly. Maxillary teeth directed backwards, in more than one row. Mandibulary teeth enlarged somewhat anteriorly, in one to three rows. Tongue attached to floor of mouth, only its tip free. Series of pores around eye and chin and on snout. Cleft of mouth reaching to behind eye. Gill-slits lateral, their openings subequal to eye and less than the distance between them. Jugostegalia present.

Body extremely elongate, smooth-skinned, slightly compressed, its width not much less than depth. Lateral line continuous. Anus in anterior third of fish. Dorsal fin originating just behind head, low for its entire

length. Anal similar to dorsal, but rays a little longer before end of tail. Pectorals present, many-rayed. Tail-tip hard-pointed, free of fins.

Coloration, after long preservation in alcohol, uniform brownish yellow, darker along back with a lighter area along each side of dorsal fin. Snout brownish. A brownish mark at rictus and another on each side of head posteriorly. Some dark blotches on dorsal and anal fins. No rings, spots or bands on body. No white spots on nape. Eye bluish.

Described and figured from the holotype, a specimen 258 mm. or 10¼ inches overall. Austr. Mus., Regd. No. I.840.

Locality.—Derby, north-western Australia; C. Lees, 1886.

Allied to the Javanese *Ophichthus lumbricoides* (Bleeker, 1852), but not so elongate, with lower dorsal fin, and different dentition (compare my figure with Bleeker, Atlas Ichth., iv., 1864, p. 56, pl. clviii., fig. 3).

The proportions and dentition separate it from other described species of the genus.

Family MYCTOPHIDAE.

ELECTRONA RISSO SALUBRIS Whitley, 1933.

(Fig. 11.)

Here illustrated from the holotype of the subspecies (Regd. No. E.5,701), taken by the "Endeavour" in Victorian waters.

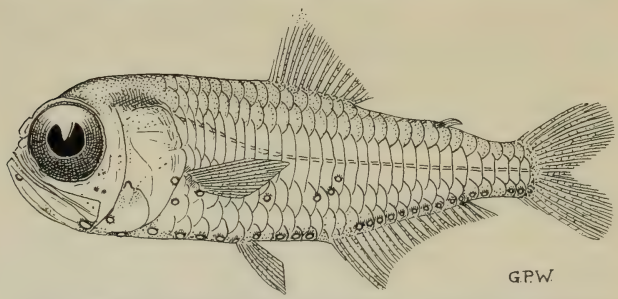

Fig. 11. Lantern Fish, *Electrona risso salubris*. Holotype of subspecies, Victoria.

DASYSCOPELUS NAUFRAGUS Waite, 1904.

? *Myctophum asperum* Richardson, Zool. Voy. Erebus & Terror, Fish., 1845, p. 41, pl. xxvii., figs. 13-15. Habitat ?

Dasyscopelus naufragus Waite, Rec. Austr. Mus., v., 3, March 11, 1904, p. 154, pl. xviii., fig. 3. Lord Howe Island.

One specimen (Austr. Mus., Regd. No. IA.8,023), 36 mm. in standard length, from New South Wales (C.S.I.R. Coll.; M.V. "Warreen" station, 104/38: about 20 miles east of Port Hacking, netted).

New record for Australia.

Family SYNGNATHIDAE.

LEPTONOTUS CARETTA (Klunzinger, 1879).

(Fig. 12.)

D. 24. Rings 17 + 42-44. Head $8\frac{1}{2}$-9. Trunk about 2 [or 3] in total length. Snout $2\frac{1}{4}$ in head. Operculum with a short ridge anteriorly. Two nuchal rings with median lengthwise ridge. Lateral ridge plain to the anal shield; lacking on tail rings or only perceptible as an interrupted line. The dorsal fin begins at the anterior end of the anal ring. Pectoral and caudal fins present, anal fin very rudimentary. Body slightly higher than broad, anteriorly, almost quadrangular.

Fig. 12. Tortoiseshell Pipefish, *Leptonotus caretta*. Holotype, Victoria.

[In October, 1937, I examined and sketched the holotype of this species in the Wurttembergische Naturaliensammlung, Stuttgart. It was a female, No. 1,810. The dorsal ridges are not continuous with the upper caudal ridges. The medio-lateral ridge bends down on the 18th ring and is also distinct from the caudal ridges. There is a median carina along belly.]

Colour: Brownish black; on the back, here and there at intervals, with light tortoiseshell-like transverse blotches or crossbands at different intervals from one another, about twelve in number.

Length, four inches.

Locality.—Port Phillip, Victoria.

NANNOCAMPUS RUBER Ramsay and Ogilby, 1886.

(Fig. 13.)

Nannocampus ruber Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales, x., 4, April 3, 1886, pp. 757 and 760, and of Australian lists. Shark Reef, Port Jackson, N.S.W. Holotype in Austr. Mus. (Regd. No. B.9,199).

On working over some unclassified pipe fishes in the Australian Museum recently, I was delighted to find a second Port Jackson specimen of this curious species, hitherto known only from the female type. Although I have often collected fishes at the type locality I have never obtained any specimens of this rarity. Possibly it lives amongst red algae in fairly deep water? Now I take this opportunity of figuring the species for the first time and add further particulars to the rather brief original description.

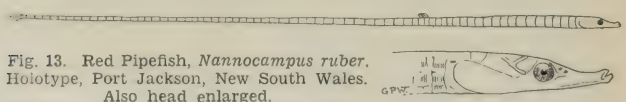

Fig. 13. Red Pipefish, *Nannocampus ruber*. Holotype, Port Jackson, New South Wales. Also head enlarged.

The holotype has the gill-slits fused, the true gill-opening being small and pore-like, superior. Anterior portions of eyes closer together than posterior. Lower profile of snout straight, upper concave. Top of head

with thick mucus canals which extend forwards to between nostrils. Operculum smooth. Dorsal fin on tail-rings 2 and 3.

Total length, 113 mm. Snout, nearly 3. Depth of head (2), a trifle less than depth or width of trunk, but equal to caudal (2). Preanal length, 35. Eye and caudal peduncle less than 1 mm.

The second specimen (Regd. No. IB.560) from South Head, Sydney, has a much longer dorsal fin, with about 26 rays and extending over 6 tail-rings, the snout is blunter and the caudal fin reduced, but in all other characters it agrees well with the type. It is apparently a female as there is no brood pouch.

SOLEGNATHUS ROBUSTUS NASO, *subsp. nov.*

D., 34; P., 30?. Rings, 26 + 55.

Head (c. 78 mm.), about 5.7 in length (c. 445), and 2.2 in trunk (175). Snout (50) 1.2 in head, its depth (8) 6.2 in its length. Eye more than 5 in snout.

Tail little more than distance between pectorals and vent, its depth behind dorsal, nearly 3½ in base of that fin.

General characters as in *S. robustus* McCulloch, 1911, but dorsal base less than length of snout, and snout more elongated (with consequent alteration in head-proportions) than in the true South Australian *robustus*.

Medio-lateral ridge of body continuous with dorsal ridge of tail. Each scute with an elevated central blunt spine, from which radiate series of crude tubercles.

Described from the holotype of the subspecies, a slightly damaged specimen, about 17 inches long (Austr. Mus., Regd. No. I.14,837).

Locality.—Purchased in the fish market, Auckland, New Zealand, January 13, 1919; coll. Charles Hedley.

Family ATHERINIDAE.

ATHERINOSOMA MICROSTOMA LINCOLNENSIS, *subsp. nov.*

D.vii., 11; A.i., 11; P.i., 11; V.i., 5; C., 15; Sc., 39; Tr., 7.

Predorsal Sc., 16. Preanal Sc., 9. Interdorsal Sc., 8.

Head (12 mm.) 4.1; depth (6) 8.3 in standard length (50). Eye, 5 mm.; interorbital, 4; snout, 3; caudal peduncle depth, 3; pectoral fin, 8.5.

Form elongate, compressed; anterior portions of back and belly not keeled but flattened. Head scaly, except before the large eyes. One row of cheek-scales. Interorbital flat. Preopercular ridges without spines; operculum sinuously curved posteriorly. A series of pores on preorbital and above and behind eyes. Mouth moderate, reaching eye, with small teeth on jaws and apparently some microscopic ones on vomer. Mandibular rami very elevated. Premaxillary processes little over half eye-diameter. Gill-rakers slender, with tiny spines; about 15 on lower limb of first branchial arch. Gill-slits wide, isthmus very narrow.

Body covered with large cycloid scales which are not crenulated. About 40 transverse and less than 8 longitudinal scale-rows. Three rows of scales above lateral stripe. Vent well in advance of anal fin, situated between inner ventral rays.

Dorsal fins well separated, the first with seven slender spines whose height is less than interdorsal space; no produced spines. Origin of first dorsal slightly nearer muzzle than root of caudal. Anal base slightly longer than that of second dorsal, but shorter than its distance from the caudal. Anal origin in advance of that of second dorsal fin. Pectorals bluntly pointed, highly inserted, the third ray longest. Ventral bases in advance of level of first dorsal origin, their tips reaching beyond vent. Caudal forked.

Colour, in alcohol, pale yellowish above, white below. A broad silvery stripe along middle of sides. Each scale of back with black margin. Top of head dark with two prominent black blots over the brain. Opercles, mouth and middle of chin infuscated. Eye silvery or bluish. Bases of all fins dusky, though the fins themselves are whitish without dark markings. A black-edged silvery band extends from ventral bases, past the vent, to taper to the anal origin.

Described from the holotype of the subspecies, a specimen 50 mm. in standard length, the largest of seven of 37 to 50 mm., or 2¼ inches overall.

Locality.—Port Lincoln, South Australia. Specimens forwarded by Sir Gerald Mussen, of Melbourne, to Dr. D. L. Serventy. Austr. Mus., Regd. Nos. IB. 662 and 664.

Differs from its allies in fin-formulae, in having slender body, dorsals behind ventrals, and only about 40 transverse rows of scales.

Family MUGILIDAE.
GRACILIMUGIL, *gen. nov.*

Orthotype, *Mugil ramsayi* Macleay, 1883.

Tropical Australian mullets with the following combination of characters, which distinguishes them from other Mugilidae. Snout shorter than eye. No adipose eyelid. Lower jaw terminal. Upper lip fairly thick. Maxillary not hidden. Mandibulary angle obtuse. No teeth. Lips very finely ciliated, without papillae. Palate hard. Preorbital margin serrated. Slope of opercular margin steep. Gill-rakers extremely numerous, about as long as gill-fringes. Pseudobranchiae small.

Body compressed, form graceful; rostro-dorsal profile convex. Depth, 3½ to 4 in standard length.

Scales in about 36 transverse rows. About 24 predorsal scales.

First dorsal origin much nearer caudal base than to snout. Scales extend on to soft dorsal and anal fins. Anterior half of anal before level of second dorsal. Eleven anal rays. Pectoral base above middle of body, a dark mark at its axil, no axillary scale; pectoral fin shorter than head. Depth of caudal peduncle about half length of head. Upper caudal lobe the longer. Coloration plain, pectorals not dusky.

Gracilimugil differs from true *Mugil* Linné, 1758 (logotype, *M. cephalus* L.), notably in having the upper lip thickened, eleven anal rays, and in lacking adipose eylids.

GRACILIMUGIL RAMSAYI (Macleay, 1883).
(Fig. 14.)

Mugil ramsayi Macleay, Proc. Linn. Soc. N.S. Wales, viii., 2, July 17, 1883, p. 208. Burdekin River, Queensland. Types (Regd. Nos. IA.5,944-5,946) in Austr. Mus., Sydney.

I select the largest of Macleay's specimen (200 mm. standard length or

10½ in. over all) as lectotype and figure it here (Austr. Mus., Regd. No. IA.5,944).

It has D.iv./i., 9; A.iii., 11; P.i., 15; C., 12 branched rays.

Sc. 37 to hypural bend. L.tr. 13 below first dorsal origin. Labial cilia very fine, invisible to naked eye. The anal fin-formula is 3/11 (misprinted 3/1 in Macleay's description). Anal origin equidistant from origins of first

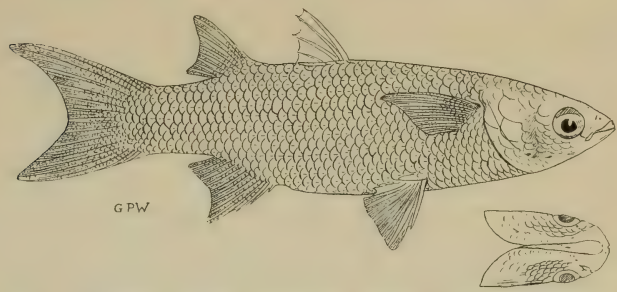

Fig. 14. Ramsay's Mullet, *Gracilimugil ramsayi*. Lectotype, Burdekin River, Queensland. Also ventral surface of head.

dorsal, ventral, and hypural joint. Other characters as defined for the genus or as described by Macleay.

Locality.—Burdekin River, Queensland; brackish water.

Genus Oedalechilus Fowler, 1904.

Oedalechilus Fowler, Proc. Acad. Nat. Sci. Philad., lv., 1903 (1904), p. 748. Orthotype, *Mugil labeo* Cuvier, Règne Anim., ed. 2, ii., April, 1829, p. 233, from the Mediterranean; figured by Cuvier and Valenciennes, pl. 310.

Mullets with no adipose eyelids. Upper lip deep, crenulated and papillate; no cilia. Lower lip curled outwards and downwards, its edges crenulated or entire. No teeth. Otherwise mostly as in *Mugil*.

Key to Australian species:—

A. Rostro-dorsal profile almost straight. Lower lip crenulated. A lenticular-shaped gap along chin between opercles anteriorly. Pectoral tip below first dorsal spine. .. .. *cirrhostomus*.

AA. Back convexly arched. Lower lip entire. Opercles meeting along median ventral line. Pectoral not reaching to below first dorsal spine. .. .. *papillosus*.

Oedalechilus cirrhostomus (Bloch and Schneider, 1801).

Mugil cirrhostomus Bloch and Schneider, Syst. Ichth., 1801, p. 121. *Ex* Forster MS. Pacific Ocean. *Id.* Forster, Descr. Anim. (*ed.* Lichtenstein), 1844, pp. 198 and 257. Tahiti (type) and Tanna, New Hebrides.

Mugil crenilabis Ogilby, Ann. Rept. Amat. Fisherm. Assoc., Qld., 1905-06

(1906), p. 9 (Southern Queensland). *Id.* Whitley, Rec. Austr. Mus., xvi., 1927, p. 11 (Michaelmas Cay, North Queensland).

Liza crenilabis McCulloch, Austr. Mus. Mem., v., 1929, p. 117. Not *Mugil crenilabis* Forskal, non-binom. = Bonnaterre.

D.iv./i., 8; A.iii., 9. Sc. 35. Tr. 10. Predorsal 17.

Head (20 mm.), 3.6; depth (17.5), about 4 in standard length (73). Snout (4), 5; eye (6), 3.3; interorbital (9); 2.2 in head. Posterior nostril lunate, anterior pore-like. No adipose eyelids. Upper lip deep, its edge crenulated, and its surface papillated, especially towards sides. No cilia. Cleft of mouth much broader than deep. Lower lip reflected downwards, crenulated. No teeth on jaws, vomer or palatines. Preorbital notched anteriorly, denticulated posteriorly. Maxillary narrow, hidden under preorbital. Gill-rakers numerous, slender, almost as long as gill-fringes. Free interopercular space on chin broad, lenticular.

Body compressed, rather elongate; rostro-dorsal profile almost straight. Scales extend on to soft dorsal and anal fins. Axillary scales to pectorals and ventrals. Depth of caudal peduncle less than half length of head.

Origins of dorsal fins corresponding to 12th and 23rd body-scales. First dorsal origin nearer base of tail than to snout. First dorsal spine reaching more than half its distance from first dorsal ray. Anal origin in advance of level of second dorsal origin. Pectoral slightly shorter than head, reaching below first dorsal spine. Caudal emarginate. Coloration plain. Pectoral axil dusky.

Described from a specimen 73 mm. in standard length or $3\frac{3}{4}$ inches over all.

Locality.—Lord Howe Island ("Thetis" Expedition), Austr. Mus., Regd. No. I.4,081. New record for the island's fauna.

Allied to the Red Sea *crenilabis* Bonnaterre, but differs from Klunzinger's figure (Fische des Rothen Meeres, i., 1884, p. 132, pl. x., fig. 2) in having Sc. 35 instead of 41, different proportions of head and depth in standard length, and first dorsal origin much nearer root of tail.

Oedalechilus papillosus (Macleay, 1883).

(Fig. 15.)

? *Mugil heterocheilos* Bleeker, Nat. Tijdschr. Ned. Ind., ix., 1855, p. 198. Batjan, East Indies. *Id.* Fowler, Mem. Bish. Mus., x., 1928, p. 126.

Mugil papillosus Macleay, Proc. Linn. Soc. N.S. Wales, viii., 2, July, 1883, p. 270, fig. of head. Normanby Island, New Guinea. Types in Austr. Mus.

? *Mugil papillosus* Tosh, Parlmt. Rept. Mar. Dept., Qld., 1902-03 (1903), p. 19, pl. ii., fig. 3 (Moreton Bay).

Mugil heterochilus Weber and Beaufort, Fish. Indo-Austr. Archip., iv., 1922, p. 258. *Id.* Duncker and Mohr, Mitt. Zool. Mus. Hamburg., xlii., 1926, p. 130 (New Pomerania and Admiralty Iss.).

Liza papillosa Jordan and Seale, Bull. U.S. Fish. Bur., xxv., 1905 (1906), p. 218. *Id.* McCulloch, Austr. Mus. Mem., v., 1929, p. 117.

The largest of three co-types of *Mugil papillosus* Macleay, in the Australian Museum (Regd. No. I.13,392) is now designated lectotype and described and figured here.

This species differs from *crenilabis* and *cirrhostomus* in having no crenulations along lower lips.

D. iv./i., 8; A. iii., 9; P. ii., 14. Sc. 35. Tr. 10. Predorsal 20.

Head (55 mm.), 4; depth (59), 3 in standard length (219). Snout (12), 4.6; eye (15), 3.7; interorbital (23) 2.4 in head.

Fig. 15. Fringed-lipped Mullet, *Oedalechilus papillosus*. Lectotype, Normanby Island, New Guinea. Also ventral and front views of head.

Nostrils oval, posterior larger. Interorbital roundly convex. Eye large, without adipose lids, 1½ in postorbital. Upper lip deep, its lower half with several rows of papillae. Lower lip entire, neither papillated nor crenulated; symphysial knob double. No cilia or teeth. Preorbital notched anteriorly, weakly denticulated posteriorly. Maxillary hidden under preorbital or its tip only showing. Opercles meeting along median ventral line; posterior margin of operculum subvertical.

Body compressed, rather deep, the dorsal profile convexly arched. Scales extend on to soft dorsal and anal fins. Axillary scales present. Depth of caudal peduncle (24 mm.) less than half head.

Origins of dorsal fins corresponding to 12th and 22nd body-scales. First dorsal fin about midway between snout and caudal base. First dorsal spine reaching more than half its distance from first dorsal rays. Anal origin in advance of level of second dorsal origin. Pectoral slightly shorter than head, not reaching to below first dorsal spine. Caudal emarginate.

Coloration plain silvery, dark along the back; pectoral axil with a dusky blotch.

Described and figured from the lectotype of *Mugil papillosus* Macleay, a specimen 219 mm. in standard length or nearly 11 inches over all.

Locality.—Normanby Island, New Guinea; fresh water.

Macleay counted D. 4, 1/7, but in two of the types there are eight rays. He also counted the small scales behind the hypural fold to give "L.lat. 38".

Allied to *Mugil heterocheilos* Bleeker, but has comparatively larger scales, more convex back, and more papillae on upper lip; however, these differences may be found to be covered by variation, in which case Bleeker's name has priority.

Genus SQUALOMUGIL Ogilby, 1908.

Squalomugil Ogilby, Ann. Qld. Mus., ix., October 14, 1908, pp. 3 and 28. Orthotype, *Mugil nasutus* De Vis.

Mullets in which the snout is produced over the undershot mouth giving a shark-like appearance to the head. Eyes small, probably protruding and mobile in life, with obsolescent adipose lids. No true teeth. Axis of body slightly curved, convex upwards. Pectoral fins large. About thirty lateral scales; 12 predorsal scales on body plus five along top of head. Allied to *Rhinomugil* Gill (Proc. Acad. Nat. Sci. Philad., 1863, p. 169. Orthotype, *Mugil corsula* Ham.-Buch.), but differs in having much larger scales (about 30 instead of about 50), lower eye, curved axis, and different relative positions of fins, judging from illustrations in Hamilton-Buchanan, Eydoux and Souleyet, Day, and Hora. The Australian Museum has a Calcutta specimen.

SQUALOMUGIL NASUTUS (De Vis, 1883).

(Fig. 16.)

Mugil nasutus De Vis, Proc. Linn. Soc. N.S. Wales, vii., 4, April, 1883, p. 621. Cardwell, Rockingham Bay, Queensland.

Squalomugil nasutus Paradice & Whitley, Mem. Qld. Mus., ix., 1927, p. 96 (Adam Bay, Northern Territory), and of modern authors.

Now figured for the first time from one of De Vis' co-types, Regd. No. I.12,693, nine inches in total length, in The Australian Museum. De Vis' description differs a little from this specimen; he overlooked the minute first anal spine, whilst in this co-type the origin of the first dorsal fin is nearer eye than caudal. Head, 50 mm.; depth, 40; standard length, 188; snout, 11; eye, 7; and interorbital, 10. Coloration not described, now faded; pectoral axil plain.

This species ranges from north Queensland to the Northern Territory and is doubtless a good food fish, growing to at least ten inches long. Nothing has been recorded about its habits, but its biology may be similar to that of its Indian ally, *Rhinomugil corsula*, of which Hora (Journ. Nat. Hist. Soc., Bombay, xl., 1, 1938, p. 62, coloured plate and 3 figs.) has given a valuable and interesting description.

Since the above was written, Mr. T. C. Marshall, of the Queensland Museum, has courteously sent me a copy of some field notes made during July, 1941, for Mr. George Coates, of Townsville, by Mr. William Watkins, of Cardwell, from which I quote the following:—

". . . There are plenty of them just about our area, but I have not noticed them anywhere else; only on one occasion whilst on my return from Brisbane, some 3 years ago. Whilst crossing what I should say is the Saint Lawrence River I noticed some small ones coming up with the making tide. . . .

"I cannot say I have seen them up to 12 inches. About 8 to 10 inches as far as I know would be about the largest size I can call to memory. They are exactly as described by you. Their eyes are really on top of their head, and they swim always with the greater portion of the head and eyes out of water. When disturbed they dive along just under water in short advances just a few yards and then to the surface again. They frequent mud flats or banks and live entirely on mud. They are always full of mud

and thus we know them as Mud Mullet. Where a mud bank say dips about 200 feet to the foot they can slide along till they are right out of water, and after puddling with their snout in the mud for a few minutes slide back into water. They are never found in deep water at all, and although they frequent our locality (a few miles either side of the town and you never see them). They are very hard to catch with an ordinary bait net, for they just slide over the cork-line. A casting net is the only way outside shooting them. I am of the opinion they like the Burnett Salmon (Ceratodus), are a lung fish, and, like the "gator", etc., must have air, and very frequently I have caught them for bait as they are good Barra bait. Have put them in a bag to keep them alive and have found they have died after being submerged for a time. They apparently must have to come to the surface for air. They are shaped like a mullet, only more curved. . . .

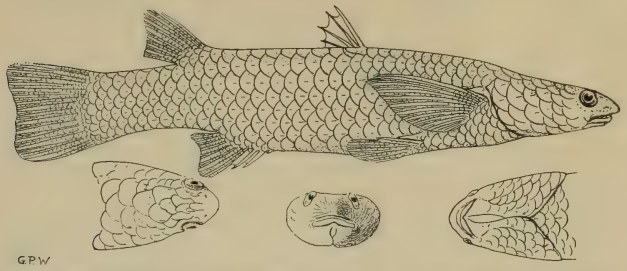

Fig. 16. Shark Mullet, *Squalomugil nasutus*. Co-type, Cardwell, Queensland. Also top, front and ventral surface of head.

"Well, I am railing to-morrow the mullet specimens, but they are a poor lot. I left home at 7 a.m. for Saltwater Creek armed with the cast net. There were not a great number up there. Why, I cannot say. Well, after chasing them for miles I fluked only one small one. They are too timid and the net landed always feet behind them. They seem more frightened than usual. I have caught a few with a cast net, but mostly shot them. I got home for lunch and got my shot-gun and went towards the One Mile Creek. There were not a great number about—mostly very small ones. At any rate, I shot about eight of them and have put them in the specimen tin. . . . I have seen them in big numbers—mostly in N.E. weather and in the summer months. I have not noticed them north of Wreck Creek and south of the One Mile Creek. Wreck Creek is 5 miles north of Cardwell, and One Mile Creek 1½ miles south of town. They do not go up the creeks, but congregate around the mud banks at the mouths and on the mud flats between both places. I have also seen them in Missionary Bay, which is a big shallow bay like our own foreshore. They are rarely seen alone—mostly in small schools, about 6 to 12. They will swim slowly north or southwards till they find another small bunch, and so on, till they congregate into a school; then they apparently split up again and so on. There appears to be two kinds; whether male or female I do not know. Some have a more pointed nose than others. . . .

"They can jump along in small jumps of a foot or so, but most dive

along in small advances, about 3 feet at a time, that is, when disturbed, but when not disturbed swim along with portion of head and eyes out of water. They have no windbag like other fish, and will drown very quickly if kept under water and cannot live out of water. . . ."

Genus Mugil Linné, 1758, *sensu lato.*

Mugil dussumieri, *auct.*

(New Hebrides form.)

D.iv./i., 8; A.iii., 9; P.ii., 14; V.i., 5; C., 12 or 13. Sc. 30. Tr. 10. About 18 predorsal scales.

Head (61 mm.), 3.8; depth (66) 3.5 in standard length (235). Snout (14), 4.3; eye (15), 4; interorbital (30) 2 in head.

Posterior nostril a lunate slit, anterior pore-like. Scales of head cycloid, some with mucous grooves. Snout shorter than eye. Adipose eyelids present, partly covering eye. Interorbital half head-length. No definite notch between nostrils to accommodate the upper lip, which is terminal, thick. Maxillary mostly hidden by preorbital. Lips entire, without cilia or papillae. Symphysial knob in lower jaw. Mandibulary angle obtuse. No teeth on palate, but microscopic teeth along lips. Margins of preorbital serrated. Slope of opercular margin steep. Opercles quite separated below head by isthmus, the interopercular space open, tapering slightly anteriorly and posteriorly. Gill-rakers numerous, decreasing rapidly in size anteriorly. Pseudobranchiae moderate.

Body robust, deep; rostro-dorsal profile rising convexly. Depth about 3½ to nearly 4 in standard length.

First dorsal origin mid-way between snout and caudal base. Second dorsal origin about opposite 22nd scale. First dorsal origin mid-way between snout and caudal base. Axillary scales large at pectorals and ventrals. Scales of body with crenulated membraneous borders. Scales extend on to proximal parts of fins, except first dorsal and ventrals. Anterior half of anal before level of second dorsal. Nine anal rays. Pectoral fin shorter than head, lower part of its base about level of middle of body; no definite dark mark at axil. Depth of caudal peduncle less than half head. Caudal emarginate, its upper lobe slightly longer than lower. Coloration plain, pectorals not dusky.

Described from the largest of six specimens, 3 to 12 inches over all, from the New Hebrides, in The Australian Museum (Regd. Nos. I.4,302, 6,374 and 13,759 to 13,761 from various donors. Only I.6,374 has a precise locality: Eraker Lagoon).

In young specimens, the maxillary is completely hidden by preorbital and the teeth are invisible. The crenulated margins of the body-scales are unsculptured in young, granulated in adult.

Family Gadidae.

Genus Austrophycis Ogilby, 1897.

Austrophycis megalops Ogilby, 1897.

(Fig. 17.)

Austrophycis megalops Ogilby, Proc. Linn. Soc. N.S. Wales, xxii., 1, September 17, 1897, p. 91. Maroubra, New South Wales. *Id.* McCulloch, Austr. Zool., ii., 2, 1921, p. 32, and of lists.

Here figured from the holotype (Regd. No. I.3,655) in The Australian Museum. The specimen is very shrivelled about the thorax, the skin is spongy and most of the scales are missing. The anal fin appears to originate below the first dorsal fin rather than the dorsal interspace, as stated by Ogilby; practically all the fin-rays are simple and articulated. The opercles are smashed and the ventral fins damaged—I cannot detect more than two ventral rays. Anal fin with anterior rays lengthened but

Fig. 17. Fork Beard, *Austrophycis megalops*. Holotype, Maroubra, New South Wales. Also dentition.

not separate from the posterior, but it is now difficult to determine the exact contour of the fins.

Colour, brownish, with dark edges to unpaired fins.

I have searched Maroubra beach, near Sydney, regularly for years without finding a second specimen. Ogilby's original label has "Mauritius" crossed out and "Maroubra" substituted. However, there is no reason to doubt the Australian locality, especially as no species like the present one appears to have been recorded from Mauritius.

Family Bregmacerotidae.

Bregmaceros nectabanus, *sp. nov.*

(Fig. 18.)

Bregmaceros mcclellandi of Australian authors, non Thompson, 1840.

Head rounded with spongy skin which even extends over eyes and opercular spines. Upper jaw the longer, maxillary reaching to below hinder part of eye. Fine teeth. No barbel.

Head, 5.5 mm.; depth of body, 5; mouth, nearly 3; standard length, 33 mm. Eye, 1.5; interorbital, less than 1 mm.; pectoral, 4 mm. Depth of body less than length of head or height of anterior dorsal and anal rays, over 6 in standard length. Scales regular, small.

D., 1/14 + 16 + 20 = 50. A., 19 + 11 + 23 = 53. Sc. 73. Tr. 17. First dorsal ray and the ventral fins depressible into channels. Interior ventral rays fringed.

General characteristics of *B. mcclellandi*, but the free median dorsal and anal rays not so dwarfed.

Yellowish-white with a brownish stripe along each side of back.

No dark markings on fins.

Described and figured from the holotype, a specimen 1¼ inches long, from Darwin, Northern Territory.

Differs from its congeners in having snout slightly less than eye and

interorbital notably less than eye, in fin and scale formulae. The pallid colour and dorso-lateral stripe and lack of dusky areas on fins are characteristic.

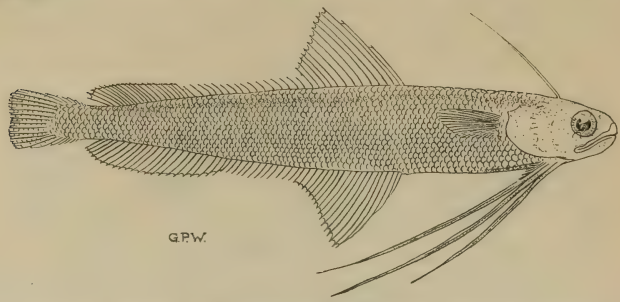

Fig. 18. Unicorn Cod, *Bregmaceros nectabanus*. Holotype, Darwin, Northern Territory.

Family HOLOCENTHRIDAE.

HOLOCENTHRUS CORNUTUS Bleeker, 1853.

Holocentrum cornutum Bleeker, Nat. Tijdschr. Ned. Ind., v., 1853, p. 240. Ceram and Amboina. *Id.* Marshall, Mem. Qld. Mus., xii., 1941, p. 55.

One (Austr. Mus., Regd. No. IA.2,150), 128 mm. in standard length, from the Great Barrier Reef, Queensland, between 17° and 19° S. Latitude (coll. W. E. J. Paradice, 1924).

HOLOCENTHRUS CORNUTUS MELANOSPILOS Bleeker, 1858.

Holocentrus melanospilos Bleeker, Act. Soc. Sci. Indo-Neerl., iii., 1858, Visch. Ambon., p. 2. Amboina.

A specimen of this variety (IA.2,151), 136 mm. in standard length, from the Great Barrier Reef, Queensland, between 17° and 19° S. Lat. (coll. W. E. J. Paradice, 1924). Both forms are figured in Bleeker's "Atlas Ichthyologique", ix., 1877, pl. ccclix.

New record for Australia.

HOLOCENTHRUS PRASLIN (Lacépède, 1802).

Perca praslin Lacépède, Hist. Nat. Poiss., iv., 1802, pp. 397 and 419. New Britain.

Holocentrus praslin Jordan and Seale, Bull. U.S. Bur. Fish., xxv., 1905 (1906), p. 225, fig. 26.

Holocentrus ruber McCulloch, Austr. Mus. Mem., v., 1929, p. 133, and of Australian authors. Not *"Sciaena rubra, ataja"* Forskaal, 1775, non-binomial, from the Red Sea.

Br., 8; D.xi./13; A.iv., 9; P.i., 12; V.i., 7. C. 18. Sc. 36. L.tr., 2½/1/6. Predorsal, 6.

Head (38 mm.), 2.7; depth (37), 2.8 in standard length (104). Eye (14), 2.7; interorbital (9), 4.2; snout (7), 5.4; depth of caudal peduncle (10), 3.8 in head. Fourth dorsal spine, 18; third anal spine, 24 mm.

Maxillary strongly ridged, reaching to below anterior half of eye; lower jaw included. Upper profile strongly convex, lower straight, slightly oblique. Villiform teeth on jaws, vomer and palatines. Premaxillary processes shorter than eye. Eye large, much longer than snout. Four ridges between eyes and fan-like occipital ridges. Nasal openings without spines. Nasalia ending in divergent spines anteriorly. Preorbital and suborbital strongly denticulated. Five rows of cheek-scales. One row of opercular scales. Preoperculum serrate with strong spine at angle reaching beyond gill-opening. Two enlarged opercular spines with three less produced lower ones. About 10 gill-rakers on lower limb of first branchial arch.

Body compressed, covered with strongly ctenoid scales. The least height of the short tapering caudal peduncle is about 1½ in its length. Membrane of first dorsal fin incised. Fourth dorsal spine longest, but shorter than penultimate one. Third anal spine very long and strong. Pectorals and ventrals subequal, as long as eye and snout. Caudal forked.

Colour, in alcohol, straw yellowish to silvery, with seven dark brown stripes along body. The first expands to a blotch below second dorsal fin, the second enlarges just before caudal root extending over median rays, the sixth forms a blotch over anal fin.

Dark blotches, adjacent to cream markings, between first, second and third; also ninth, tenth and eleventh dorsal spines. Upper and lower caudal rays brownish, also membranes between third anal spine and second anal ray. Ventral tips dusky. Eyes bluish and yellowish.

Described from a specimen, 104 mm. in standard length, or 5 inches over all, from the Northern Territory of Australia (Rev. W. S. Chaseling); Austr. Mus., Regd. No. IA.8,098.

Other specimens, up to 10 inches long, are in the Australian Museum, from various parts of Queensland: Hayman Island (IA.6,006), North Barnard Island (IA.2,149 and 2,242), Howie Reef (IA.2,226), Lindeman Island (IA.7,485 and 7,878), also a Wide Bay example (E.1,500), taken by the "Endeavour". The Queensland Museum has one from Prince of Wales Island, north Queensland.

Genus Holotrachys Günther, 1873.

Holotrachys lima (Cuv. & Val., 1831).

Myripristis lima Cuvier and Valenciennes, Hist. Nat. Poiss., vii., 1831, p. 493. Mauritius.

Myripristis humilis Kner and Steindachner, Sitzungsb. Akad. Wiss. Wien., liv., 1866, p. 357, pl. i., fig. 1. Samoa.

Myripristis (*Holotrachys*) *lima* Günther, Journ. Mus. Godef., ii., 7, Fische der Südsee, 3, February, 1874, p. 93, pl. lxiii., fig. A.

Harpage rosea De Vis, Proc. Linn. Soc. N.S. Wales, viii., 4, February 21, 1884, p. 447. South Sea Islands.

Myripristis carneus Ramsay and Ogilby, Proc. Linn. Soc. N.S. Wales (2), i., August 23, 1886, p. 474. Admiralty Is.

Holotrachys lima and *roseus* Jordan and Seale, Bull. U.S. Bur. Fisher., xxv., 1905 (1906), p. 222, fig. 25.

This species is distinguished by having about 36 to 47 lateral scales Kner and Steindachner's paper is not available to me.

De Vis' description of *Harpage rosea* agrees very well with Günther's description and figure of *Holotrachys lima*, although De Vis seems to have

overlooked the minute first anal spine. *Harpage* thus becomes a synonym of *Holotrachys*, and *rosea*, like *Myripristis carneus* Ramsay and Ogilby, apparently equals *lima*.

HOLOTRACHYS OLIGOLEPIS, *sp. nov.*

(Plate i., fig. 19.)

D., xii./14; A.iv., 11; P.i., 14; V.i., 7; C., 17; L.lat., 32. L.tr., 4/1/7½. About 5 predorsal scales.

Upper profile ascending evenly, flat along back and descending steeply below soft dorsal. Lower profile similar but less convex.

Head (52 mm.), 2.5; depth (60) 2.2 in standard length (131). Eye (15), 3.4; interorbital (9), 5.7; snout (14), 3.7; depth of caudal peduncle (12) 4.3 in head. Third dorsal spine, 25 mm.; third anal spine, 20 mm.

Maxillary and supramaxillary rugosely ridged and reaching to posterior portion of eye. Lower jaw slightly longer than upper, its tip fitting into a symphysial excavation. Coarse teeth on each side of jaws, some of them exterior to gape (anterolaterally on premaxilla and anteriorly on mandible). Smaller teeth on vomer and palatines. Premaxillary processes shorter than eye. Eye large, equal to snout. Nasalia almost meeting over premaxillary processes and ending anteriorly in several spines, some of which overhang upper lip. They are very rugose, like all the bones of the head, including the supraorbital and two interorbital ridges. Preorbital strongly and irregularly dentate, continuous with postorbitals. Both limbs of preoperculum strongly toothed and with a short, acute, somewhat enlarged spine at angle, not reaching gill-opening. Four or five rows of cheek-scales. Opercles crossed by ridges ending in marginal spines, of which several are a little enlarged at angle. One row of opercular scales. Pseudobranchiae present. About ten gill-rakers on lower part of first branchial arch.

Body oval, fairly compressed, covered with strongly ctenoid scales which do not extend on to fins. Height of caudal peduncle about half its length.

Membrane of first dorsal fin incised; spines striated, the third spine longest, much longer than the rays of the rounded second dorsal fin; last dorsal spine little shorter than penultimate and joined by membrane to first dorsal ray. Third anal spine enlarged, subequal to longest anal rays. Pectorals and caudal lobes rounded; ventrals pointed. Ventral and anal spines striate.

Colour, after long preservation in formalin, brownish, with traces of nine broad dusky stripes along scale-rows; dorsal membranes whitish; eye bluish; no spots on body or fins. In life, it may have been red with, perhaps, some white or cream on first dorsal membranes.

Described and figured from the unique holotype of the species, a specimen 131 mm. in standard length or six inches over all.

Locality.—Western Australia, trawled between Cape Naturaliste and Geraldton, in from 20 to 100 fathoms; F.I.V. "Endeavour". Regd. No. E.2.479.

Differs from other *Holotrachys*, notably in having a less deep body, larger and fewer scales, and less extensive maxillaries.

Family APOGONIDAE.

Genus SIPHAMIA Weber, 1909.

Siphamia Weber, Notes Leyden Museum, xxxi., 2, 1909, p. 168. Haplotype

S. tubifer Weber, from Timor. *Id.* Weber, Siboga Exped., lvii., Fische, 1913, pp. 219 to 221, 243 to 246 and 672, pl. x., figs. 9a-b, and fig. 61. *Id.* Jordan and Jordan, Mem. Carneg. Mus., x., 1, 1922, p. 44. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip., v., 1929, p. 355, fig. 84. *Id.* Fowler and Bean, Bull. U.S. Nat. Mus., 100, x., 1930, p. 142.

SIPHAMIA CUNEICEPS, *sp. nov.*

(Fig. 20.)

D. vi./i., 7 or 8; A. ii., 8; P., 12; V. i., 5; C. 17.

Head (15 mm.), 2.6; depth (10), 3.9 in standard length (39). Eye (4), 3.75; interorbital (4.5), 3.3; snout (5) 3 in head.

Head, wedge-shaped, pitted above, the convex interorbital and snout with mucous canals; other pores and canals around eyes, chin and preoperculum. Eyes large. Snout long and pointed. Nostrils large. Mouth large, reaching to below posterior part of eye. Lower jaw longer. No canines, only fine villiform teeth on jaws, vomer and palatines. Tongue edentulous. Both limbs of preopercle entire. Operculum with two obsolescent spines. Predorsal profile obliquely sloping. Six long gill-rakers on lower half of first branchial arch.

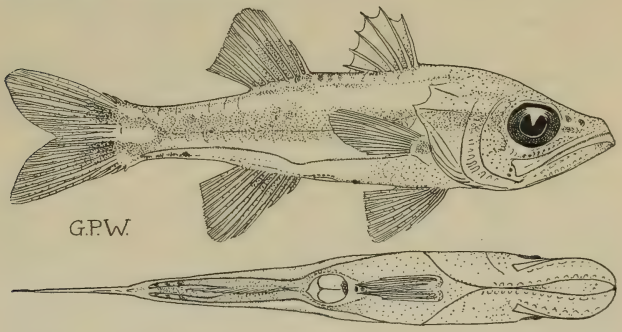

Fig. 20. Siphon Fish, *Siphamia cuneiceps*. Holotype, Queensland. Ventral surface, below.

Depth of body much less than length of head. Body compressed, rather elongate. A silvery tube (prolongation of peritoneum) along each side to the short and deep caudal peduncle. Scales large, deciduous, ciliated. L.lat. apparently complete, probably with less than 20 scales. Most of scales missing in my specimens, but predorsal ones not keeled. Vent just in front of anal fin; opening of oviduct large, with two pinkish lappets. Dorsal fins not connected at base, none of the spines produced or serrated. Caudal forked.

Brownish-pink with broad lateral infuscated area suggesting a dark median stripe and a smaller similar band above and below along sides and head; the central band splits into two on root of tail. Silvery tubes out-

lined blackish. Fins white, proximal part of soft dorsal and anal with dense blackish speckles. Lower surface of caudal peduncle dusky. Tongue blackish at sides. No ocelli.

Described from the holotype of the species, a spawning female, 39 mm. in standard length or 1⅞ inch over all, one of three specimens 36 to 39 mm. in standard length. Austr. Mus., Regd. No. IB.1,016.

Locality.—Off Fraser Island, Queensland; 24° 52 min. S. lat. by 152° 48 min. E. long.; Agassiz trawl, 15 mins.; 15 fathoms, 14/9/1938, M.V. "Warreen". Presented by Dr. H. Thompson, C.S.I.R., Marine Biological Laboratory. Differs from *Siphamia tubifer* Weber, 1909, from Timor, in having comparatively longer head and more elongate body, different fin-formulae, dentition, etc. True *Siphamia* and *Fodifoa* have much deeper bodies than my Frazer Island species. *Adenapogon* and *Scopelapogon* have more numerous gill-rakers, cycloid scales and lower pectoral insertion.

Family GYMNAPOGONIDAE.

Genus GYMNAPOGON Regan, 1905.

Gymnapogon Regan, Ann. Mag. Nat. Hist. (7), xv., 1905, p. 19. Type, *G. japonicus* Regan. *Id.* Regan, Ann. Mag. Nat. Hist. (8), xii., 1913, p. 118. *Id.* Jordan, Classif. Fish., 1923, p. 188. *Id.* Schultz, Proc. U.S. Nat. Mus., lxxxviii., 1940, p. 406. *Id.* Regan, Copeia, 1940, 3, p. 173.

Henicichthys Tanaka, Zool. Mag., Tokyo (Dobuts. Zasshi), xxvii., 1915, p. 568. Orthotype, *H. foraminosus* Tanaka, from Japan. Described in Japanese. *Id.* Tomiyama, Jap. Journ. Zool., vii., 1936, p. 50. *Id.* Tanaka, Fish. Japan, 1936, p. 270. *Id.* Fowler, Notulae Nat., xxvi., 1939, p. 1. *Id.* Herre, Copeia, 1939, 4, p. 200.

Hemicichthys (sic) Jordan, Classif. Fish., 1923, p. 203 (translation of Tanaka's description).

Australaphia Whitley, Mem. Qld. Mus., xi., 1, 1936, p. 48. Orthotype, *A. annona* Whitley, from Queensland.

This puzzling little genus has been placed in a different family by almost every author who has dealt with it, and it has been described under three generic names, the oldest of which becomes the root for the family name. It is apparently a highly specialized ally of the Apogonoids. Dr. Katsuzo Kuronuma, whilst working with Professor Carl L. Hubbs, in Michigan, found that my *Australaphia* was a *Henicichthys* and showed me specimens at Ann Arbor to prove his discovery. So far as I know this synonymy has not been published, but I am now unable to communicate with Dr. Kuronuma, who has returned to Japan, so place this on record with full acknowledgment to him. Recently, Regan has demonstrated the identity of *Henicichthys* with his *Gymnapogon*. The synonymy and bibliography of this genus are tabulated above for the first time.

There are several species in Pacific Seas: *G. japonicus* (*foraminosus*), *philippinus*, and *annona*. The Australian Museum has some old specimens of this genus from Cairns Reef, near Cooktown, Queensland, and the New Hebrides, which had been provisionally identified as "Amiidae" and came to light during recent overhauling of the stored collections.

Family CARANGIDAE.

BASSETINA, *gen. nov.*

Zamora Whitley, Rec. Austr. Mus., xviii., 3, March 25, 1931, p. 108. Ortho-

type, *Caranx hullianus* McCulloch, Rec. Austr. Mus., vii., 4, August 30, 1909, p. 319, pl. xci., from Freshwater Beach, near Sydney, New South Wales. Type in Australian Museum (I.9,261). Preoccupied by *Zamora* Roewer, Abh. Naturw. Ver. Bremen., xxvi., 1928, p. 541, a genus of Arachnida.

I notice from Neave's "Nomenclator Zoologicus" that my genus *Zamora* is preoccupied. I therefore propose the above substitute. Orthotype, *Caranx hullianus* McCulloch = *Bassetina hulliana.*

Named in honour of Mr. Arthur Francis Basset Hull, M.B.E., veteran zoologist and doyen of the Royal Zoological Society of New South Wales, who collected the still unique holotype over 33 years ago.

Family ARRIPIDAE.

ARRIPIS TRUTTA (Bloch & Schneider, 1801).

In the Museum National d'Histoire Naturelle, Paris, in October, 1937, I saw the type of *Lepidomegas mulleri* Thominot, 1880, from Melbourne. This genus had been made a synonym of *Seriola* by Jordan and others, yet I could never reconcile Thominot's description with any Australian Seriolid. Seeing the type-specimen explained why: it was a Kahawai with 16 dorsal rays and 51 scales on the lateral line to the hypural joint, and thus *Lepidomegas mulleri* becomes a synonym of *Arripis trutta,* both genus and species, and has no relationship to *Seriola.*

If the south-eastern Australian "Salmon" be distinct from the New Zealand type, it may assume the name *marginata* Cuv. & Val., 1828, originally described as a *Perca.* The Western Australian form may represent a new subspecies which has yet to be defined and named.

Family LEIOGNATHIDAE.

EQUULA, *spp.*

The old and damaged holotype of *Equula serrulifera* Richardson, 1848, from "Australia" was examined by me in the British Museum. It had depth less than 2 in standard length, small teeth, dorsal spine not abnormally serrated, and, as far as I could make out from the smashed head, the supraorbital was smooth. It was very like *E. decora* De Vis, 1884, but had longer anal spine and slightly deeper body.

In Stuttgart, in 1937, I saw the type of *Equula splendens* var. *novemaculeata* Klunzinger, 1879, from the Endeavour River, Queensland. This was apparently only an abnormal specimen of *decora* with 9 dorsal spines, the last of which is merely an ossified ray. Dentition well developed, supraorbital not serrate, a preorbital spine, lateral line complete, thorax naked, size small. Also in Stuttgart, I saw the holotype of *Equula novaehollandiae* Steindachner, 1879, which is an *Equulites.*

In the Zoological Museum of the University, Copenhagen, Denmark, I saw, amongst Forskal's types, his *"Scomber equula",* which is an *Equula* rather than a *Leiognathus.*

Family MULLIDAE.

PARUPENEUS SUFFLAVUS, *sp. nov.*

(Fig. 21.)

D. viii./i., 8; A. i., 6. L.lat., 28. Tr., 2/1/6½.

Head (59 mm.), 3.2; depth (62) 3 in standard length (190). Eye (12),

nearly 5; interorbital (17), 3.4; barbel (30), about 2; second dorsal spine (32) 1.8 in head.

Head longer than high, slightly excavate before eyes, scaly except tip of snout and on lower surfaces. Eye small, nearer edge of operculum than tip of snout. A single series of spaced peg-like teeth in jaws, none on vomer and palatines. Maxillary not reaching eye, its depth subequal to eye-diameter. Barbels not reaching preopercular margin. Gill-rakers about 18, plus rudiments, on lower half of first branchial arch.

Form rather robust and deep. Ventral scales weakly carinate. Lateral line tubes arborescent.

Second dorsal spine fairly rigid, not produced, not reaching soft dorsal when adpressed. Soft dorsal and anal fins naked, their lobes pointed. Last dorsal and anal rays not produced. Caudal shorter than head, its proximal half scaly.

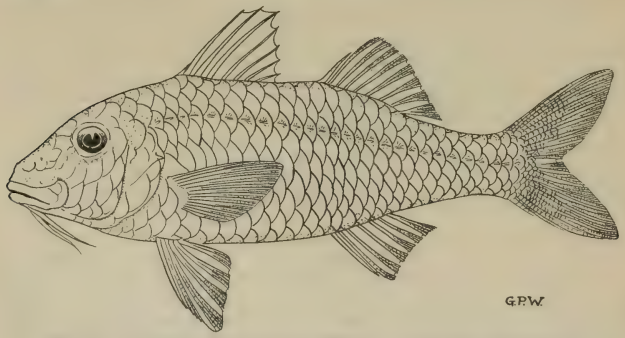

Fig. 21. Goatfish, *Parupeneus sufflavus*. Holotype, Queensland.

Colour in alcohol fairly uniform yellowish-brown, each scale with light or pearly centre causing rows of light and dark band-like markings. Back light behind soft dorsal fin. Fins with large light spots. No dark stripes or spots. Oblique bars may have crossed the head near eyes.

Near the *luteus* and *pleurospilus* of authors. Differs from *luteus* Cuv. & Val., in eye and preorbital characters, shorter barbels, etc., and from *pleurospilus* in lacking the characteristic colour-markings of that species and having much shorter barbels.

Described from the holotype of the species, a specimen 190 mm. in standard length or 9¾ inches over all. Austr. Mus., Regd. No. IA.294.

Locality.—Holbourne Island, off Port Denison, Queensland; Mr. E. H. Rainford, 1921.

PENNON, *gen. nov.*

Orthotype, *Upenoides filifer* "Ogilby, 1910" = *Pennon filifer*.

Interorbital convex. Snout short. Maxilla barely reaching below eye, its depth less than eye-diameter. Eye in middle of head length. Teeth of

jaws in narrow villiform bands. Vomer and palatines toothless. Velum maxillae crenulated. Head scaly to snout, preorbital apparently scaly. About thirty transverse series of scales. Ventral scales carinate.

Second dorsal spine extremely long and flexible, reaching caudal peduncle. Soft dorsal and anal fins scaly anteriorly.

Coloration rosy and yellowish, without striking bars, spots or stripes.

Definition drawn up from one of Ogilby's co-types (Austr. Mus., Regd. No. I.12,541).

This genus differs from all other Mullidae in having long dorsal spine and in characters of dentition, etc.

PENNON FILIFER, *sp. nov.*

(Fig. 22.)

Upenoides filifer Ogilby, New Fish. Qld. Coast, December 20, 1910, p. 95. Off Cape Gloucester. Queensland. Paper printed but not published.

Upeneus filifer McCulloch and Whitley, Mem. Qld. Mus., viii., 1925, p. 156.

Although mentioned by various authors, this species has not hitherto been described in a scientific publication. Ogilby's account was as follows:—

D. viii./i., 8; A. i., 6; P., 13; Sc., 2/32/6. Depth of body, 3.8; length of caudal peduncle, 4.3; of head, 3.55; longest dorsal spine, 2.05; length of caudal fin, 3.85; of pectoral, 4.8; of ventral, 4.9 in length of body. Length of snout, 2.2; diameter of eye, 3.85; width of interorbit, 3.3; width of maxillary, 2.8 in length of head.

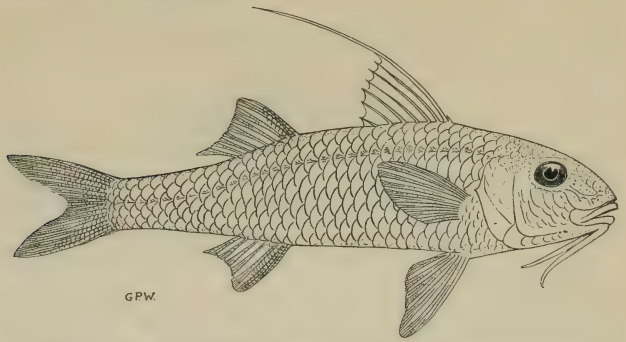

Fig. 22. Pennant Goatfish, *Pennon filifer*. Holotype, Queensland.

Body somewhat robust; caudal peduncle rather short and stout, its least depth 2.35 in its length and 1.3 in the length of the snout. Upper profile of head gently rounded; diameter of eye 1.75 in the length of the snout, and 1.15 in the convex interorbit; maxillary not quite extending to below the anterior border of the eye, the width of its distal extremity 2.4 in the eye-diameter; barbels short and rather stout, reaching to or slightly beyond the angle of the preopercle. Opercle with a small spine superiorly;

a short stout scapular spine. Extremity of snout and intermandibular region naked, rest of head scaly; cheek-scales in 4, interopercular in a single series; 5 complete scales between the dorsal fins; tubes of lateral line but sparsely branched, those of the peduncle bifid or simple.

Spinous dorsal originating above the base of the pectoral, its length without the terminal membrane equalling that of the soft dorsal; 1st spine very small; 2nd longest and greatly produced, extending when depressed beyond the base of the soft dorsal; soft dorsal as high as long, the anterior rays longest, 3.33 in the 2nd spine; last ray a little longer than the penultimate. Caudal deeply forked, the middle rays 2.3 in the upper lobe. Anal originating below the 2nd dorsal ray, its 1st ray longest, as long as or a little shorter than the 1st dorsal ray, and reaching when laid back to the tip of the last ray. Pectoral rounded, the 3rd ray longest, extending when appressed to below the 11th scale of the lateral line. Ventral a little longer than the pectoral, the spine nearly as long as the 2 outer and longest rays, which reach mid-way or rather less than mid-way between its origin and the base of the last anal ray.

Above roseate, shading through the pink of the sides to the pearly white of the throat and abdomen. Cheeks and opercles washed with gold; barbels lemon yellow. Iris purple with a narrow silver rim inferiorly. Dorsal and caudal fins pink, basally washed with gold; other fins colourless.

Total length, 170 millim.

Described on board the Endeavour from 2 specimens, 166 and 137 millim. long, obtained off Cape Gloucester; total number trawled 12.

Family CHEILODACTYLIDAE.

Genus NEMADACTYLUS Richardson, 1839.

Nemadactylus Richardson, Proc. Zool. Soc. Lond., vii., November, 1839, p. 97. Haplotype, *N. concinnus* Richardson.

Sciaenoides Richardson, Rept. 12th meet. Brit. Assoc. Adv. Sci., 1842 (1843), pp. 18-19. Logotype, *S. abdominalis* Richardson, selected by Whitley, Rec. Austr. Mus., xix., 1935, p. 235. Not *Sciaenoides* Blyth, 1860, a genus of Jewfishes.

Dactylopagrus Gill, Proc. Acad. Nat. Sci. Philad., xiv., May, 1862, p. 114. Orthotype, *Cheilodactylus carponemus* Cuv. & Val. Spelt *Dactylosparus* on p. 117.

Nematodactylus Gill, Proc. Acad. Nat. Sci. Philad., xiv., May, 1862, pp. 114 and 121. *Id.* Boulenger, Zool. Rec., 1880 (1881), Pisces, p. 8. Emend. for *Nemadactylus*.

The little fishes hitherto known as Paper Fish and Silvery Threadfin (*Nemadactylus, Evistius, Platystethus*) in south-eastern Australia and New Zealand, are actually young morwongs and trumpeters, an identity first hinted at, apparently, by Barnard regarding the South African *Palunolepis*. Examination of specimens and checking accounts in literature show that these post-larval forms may be linked up, with a fair degree of certainty, with the adult forms. In several cases the young ones have been given quite different generic names from the adults or even placed in far-away families. Consequently some synonymy is unavoidable.

The little fish described by Richardson in 1839 as *Nemadactylus concinnus* is evidently the young of the Jackass Fish, a morwong of the genus

generally known as *Dactylopagrus* or *Sciaenoides*, but these two names are of much later date, so should fall as synonyms of *Nemadactylus*. The Jackass Fish, therefore, should be called *Nemadactylus macropterus* from New Zealand, the name *concinnus* replacing *aspersus* for the Tasmanian subspecies, if distinct.

Young morwongs of the *Nemadactylus* group have 17 or 18 dorsal spines, 28 dorsal rays, 3 anal spines and 15 to 17 anal rays; the lateral line bears about 50 to 55 scales; the lower pectoral rays are lengthened; length about 3 inches.

Family LATRIDIDAE.

Genus LATRIDOPSIS Gill, 1863.

LATRIDOPSIS FORSTERI (Castelnau, 1872).

(Fig. 23.)

Latris forsteri Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 77, and p. 79, as *L. bilineata* and *inornata*. Melbourne Market.

? *Platystethus huttonii* Günther, Ann. Mag. Nat. Hist. (4), xvii., May 1, 1876, p. 395. Dunedin, New Zealand.

Latris ramsayi Ogilby, Proc. Linn. Soc. N.S. Wales, x., July, 1885, p. 229. Sydney Markets, New South Wales.

Evistius huttonii tasmaniensis Whitley and Phillips, Trans. Roy. Soc. N. Zeal., lxix., 2, September, 1939, p. 234. On *E. huttonii* McCulloch, Rec. Austr. Mus., xiv., 2, 1923, p. 121, from Tamar River, Tasmania. Not *Platystethus huttonii* Günther, Ann. Mag. Nat. Hist. (4), xvii., 1876, p. 395, from New Zealand.

Here figured from the holotype of the subspecies *Evistius huttonii tasmaniensis* (Austr. Mus., Regd. No. I.6,222), which proves to be a juvenile

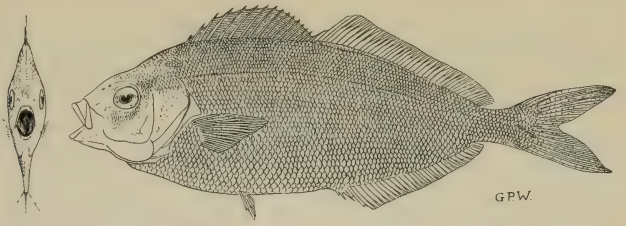

Fig. 23. Paper Fish, the Young Silver Trumpeter, *Latridopsis forsteri*. Holotype of subspecies *Evistius huttonii tasmaniensis*, Tamar River, Tasmania. Also front view.

Latridopsis forsteri, hence the above synonymy. It has D.xvi./43; A.iii., 35. No vomerine teeth. Body compressed. Opercles mostly scaleless. L.lat. 103 circa. Tr. 10/1/c22.

Fairly uniform brownish, darker along back, after long preservation in alcohol. First dorsal fin dark. A dusky blotch behind eye. Eight inches over all.

Locality.—Tamar River Heads, Tasmania.

Barnard (Ann. S. Afr. Mus., xxi., 2, 1927, p. 454) stated that *Evistius huttonii* was a young Cheilodactylid, but, as it has more than 30 anal rays, it must enter the Latrididae.

It seems that the subspecies *tasmaniensis* at least is young *Latridopsis forsteri*. Thus *Evistius* becomes a synonym of *Latridopsis* and should be transferred from the Labracoglossidae (members of which have less than 30 anal rays) to the Latrididae. We may, however, use the term for the juvenile form and speak of the *Evistius* stage of a Latridid fish just as we speak of the *Leptocephalus* of an eel. R. M. Johnston has given a good account of the "Paper-fish" fry of *Latridopsis* in Tasmania.

Family Coridae.

Genus Guntheria Bleeker, 1862.

Guntheria devisi, *sp. nov.*
(Fig. 24.)

D.ix., 11; A.iii., 10; L.lat. 26. Tr. 1/1/7.

Head mostly naked; a few scales on cheeks and opercles. Curved canines in jaws not flaring outwards (2 in upper, 4 in lower) anteriorly. Lateral teeth uniserial, as a ridge. Posterior canine present. Lips normal. Preopercular margin entire.

Fig. 24. Parrot Fish, *Guntheria devisi*. Holotype, Queensland.

Form rather elongate, compressed. Depth about 4 in standard length. Thoracic scales slightly smaller than those of body.

L.lat. continuous, bent behind. No scaly sheaths to dorsal and anal fins. Dorsal spines not elevated, their membranes slightly penicillated, the front spines not divergent. First ventral ray filamentous. Caudal convex.

Pale yellowish with a faint olive band along upper sides. Fins whitish. No blotches on dorsal. Dusky bar on snout and two indistinct oblique bars behind eye. An indistinct dusky blotch, subvertical on side above about end of pectoral. A conspicuous blackish spot on upper part of root of tail. Eye bluish. Eggs small, salmon-pink.

Described from the holotype, a spawning female, a little over three inches long (Regd. No. IB.1,033).

Locality.—Off Frazer Island, Queensland; 24° 52 min. S. lat. by 152° 48 min. E. long.; 15 fathoms. Agassiz Trawl, 15 minutes; 14/9/1938. M.V. "Warreen". Presented by Dr. H. Thompson. Holotype and paratypes, Regd. Nos. I.B.1,033-1,034, in Australian Museum.

Named after C. W. de Vis, who described many Queensland parrot fishes many years ago.

Rather like *Halichores bimaculatus* Rüppell, but has different coloration and has caudal ocellus, also only 1 row of scales over lateral line, and is much smaller in size.

Genus Duymaeria Bleeker, 1856.

Duymaeria Bleeker, Act. Soc. Sci. Indo-Neerl., i., 1856, p. 52. Logotype, *Ctenolabrus aurigarius* Richardson, Zool. Sulphur. Fish., 1845, p. 90, pl. xlv., figs. 1-2, from Canton, China, selected by Jordan, Tanaka and Snyder, Journ. Coll. Sci. Imp. Univ. Tokyo, xxxiii., 1, 1913, p. 199, as *Crenilabrus*.

Labrastrum Guichenot, Rev. Mag. Zool. (2), xii., 1860, p. 152. Orthotype, *Ctenolabrus flagellifer* Cuvier and Valenciennes, 1839.

Small parrot-fishes with preoperculum serrate, anterior dorsal spines and membranes elevated into a crest, two rows of cheek-scales, and little more than 20 scales in the complete lateral line.

Duymaeria flagellifera (Cuv. & Val., 1839).

Ctenolabrus flagellifer Cuvier and Valenciennes, Hist. Nat. Poiss., xiii., 1839, p. 240. Locality unknown.

Duymaeria flagellifer Fowler and Bean, Bull. U.S. Nat. Mus., 100, vii., 1928, p. 216 (refs. and synon.).

Thirteen specimens, 36 to 77 mm. in standard length, from off Frazer Island, Queensland; 24° 52 min. S. lat. x 150° 48 min. E. long. Caught in 15-minute Agassiz trawl from M.V. "Warreen" in 15 fathoms, 14th September, 1938. Australian Museum, Regd. Nos. I.B.1,035-1,036. Presented by Dr. H. Thompson, C.S.I.R. Marine Biological Laboratory, Cronulla, New South Wales.

New record (genus and species) for Australia. Extralimital in the East Indies, Philippines, Formosa, China and Japan.

Family Bodianidae.

Verreo unimaculatus (Günther, 1862).

Mr. T. Payten recently secured a specimen of this Pigfish at Lord Howe Island, from which place it has not hitherto been recorded. It is fairly common in eastern Australia and has been recorded from Norfolk Island on the basis of a painting by George Raper made in the eighteenth century.

Family Callyodontidae.

Pseudoscarus pulchellus (Rüppell, 1835).

Scarus pulchellus Rüppell, Neue Wirbelth. Abyssin. Fische., 1835, p. 25, pl. viii., fig. 3. Djetta. *Id.* Delsman & Hardenberg, Indische Zeevisschen, 1934; coloured plate opp. p. 250.

Callyodon pulchellus Fowler & Bean, Bull. U.S. Nat. Mus., 100, vii., April 17, 1928, p. 423 (refs. & syn.). *Id.* Fowler, Mem. Bish. Mus., x., 1928, p. 379, *et ibid.*, xi., 1934, p. 440.

The Australian Museum recently received a fine specimen, 19½ inches over all, from the Gizo district, Solomon Islands (Regd. No. IB.666)—a new record for the Solomon Islands. This species can now be added to the Australian list, as Mr. T. C. Marshall showed me one in the Queensland Museum from Cape Upstart, Queensland, painted by Mr. George Coates (Regd. No. Qld. Mus., I.6,157).

Heteroscarus acroptilus (Richardson, 1846).

In September, 1937, I had the pleasure of seeing Ferdinand Lucas Bauer's drawings of New Holland animals in the British Museum (Natural History). The draughtsmanship and colouring were superb and the species

easily determinable. Drawing No. 35 represented the type of *Scarus acroptilus* Richardson, 1846, and showed the species usually known in Australia as *Heteroscarus filamentosus* Castelnau, 1872. However, Castelnau's trivial name can now be sunk as a synonym of *acroptilus*.

Family BLENNIIDAE.

PETROSCIRTES (OSTREOBLENNIUS) STEADI Whitley, 1930.

Mr. Tom Iredale has collected this species in the Noosa River, Queensland (Austr. Mus., Regd. Nos. IA.7,987-88).

Two specimens from three to four miles east of the Burnett River, Queensland; Agassiz trawl, 10 fathoms, 15 mins., 14/9/38, are in the C.S.I.R. collection, Cronulla, New South Wales.

New records for Queensland.

PETRAITES NASUTUS (Günther, 1861).

In December, 1937, I examined the type of *Cristiceps nasutus* Günther, 1861, in the British Museum. It is a small specimen of the species called *Petraites fasciatus* (Macleay, 1881), by McCulloch (Rec. Austr. Mus., vii., 1908, p. 42, pl. xi., fig. 2). This species must henceforth be called *Petraites nasutus* (Günther).

Mr. T. C. Marshall, of the Queensland Museum, caught two specimens of this species in rock pools at Caloundra in August, 1941.

New record for Queensland.

Family CLINIDAE.

CLINUS MARMORATUS Klunzinger, 1872.
(Fig. 25.)

Br., 6; D., 44; A., 30; P., 13; V., 3; C., 10. Height, 5 (before the vent); head, 6; breadth, 2; eye, 4; forehead, 1½; snout, 1; preorbital, 3; anterior dorsal fin, 5; posterior, 2½; tail, 8.

Fig. 25. Marbled Weedfish, *Clinus marmoratus*. Lectotype, Port Phillip, Victoria.

Body very elongated, compressed. Profile of head parabolic, anteriorly somewhat more curved on snout. Snout obtuse, short. Teeth in both jaws, in a band anteriorly, laterally in a row, very short and obtuse. Vomer, but not palatine, toothed. Maxillary reaches to below middle of eye. Eyes moderate, with a minute simple cirrhus on the upper border. Interorbital space smaller than the eye. Head, velvety, occiput wholly scaleless. Remainder of body with small, rather indistinct, non-imbricate brown scales. Lateral line showing only anteriorly; it runs straight to the point of the pectorals, when it tends to drop downwards but soon vanishes. It is

formed of closely arranged longitudinal keels. Dorsal fin beginning just above the gill-covers, the anterior flexible spines are the shortest and not removed from the others; the first spines behind middle become markedly higher, particularly the penultimate five, which remain undivided, united posteriorly to the base of the tail by membrane. Anal similar with simple flexible spines; it begins below the fourteenth dorsal spine, the membrane behind the last ray not reaching the caudal fin. Pectorals ovate, not reaching vent. Ventrals with three undivided rays, of which the middle is the longest and reaches to middle of pectoral; the outer a little shorter, the inner very short; their insertion is jugular close behind the gill-membrane. Caudal elongate, rounded.

Colour, brown, marbled with darker spots, throat sometimes sprinkled with white. Fins punctated with blackish marbled with some light areas. Pectorals clear, darker spotted.

Length, six inches.

Locality.—Port Phillip, Victoria.

Klunzinger stated this species came near *Clinus cottoides* C. & V., and *despicillatus* Richardson, but was distinct. Two type-specimens of this species were seen by me in Stuttgart. I select the larger as lectotype; total length, 144 mm.

Coloration uniform brown after nearly seventy years in alcohol. Some dark brown margins to dorsal and anal fins. Light spaces at intervals along dorsal fin and on last ray. The proportions vary a little from those described by Klunzinger.

Family Stichariidae (Ophiclinidae, *olim*).

Sticharium dorsale Günther, 1867.

Ophiclinus gracilis Waite, 1906, agrees well with Günther's account of *Stichārium dorsale* and should evidently become a synonym of the latter. *Stichārium* is of earlier date than *Ophiclinus* for the genus and family name. For references, see Austr. Mus. Mem., v., 1929, pp. 352-358.

Family Notograptidae.

Genus Notograptus Günther, 1867.

Notograptus gregoryi, *sp. nov.*

(Plate i., fig. 26.)

Head (11 mm.), 7; depth of body (6), 13 in total length (78 mm.). Eye (2 mm.), subequal to caudal base (2) and greater than snout (1.5) or interorbital (1.5).

Form, eel-like, elongate. Head, long, naked, pointed, wider than high behind eyes. Snout bluntly rounded. Anterior nostrils flap-like. Interorbital slightly concave. Profile rising gibbously from nape to back. Eye small, anterior orbital margin free. Series of small round pores around eyes and opercles and chin. Preopercular margin subcutaneous. A broad flap at gill-opening. Opercle entire, not striated, unarmed, not excavated above. A blunt barbel on chin. Gape reaching well behind eye. Lower jaw included. Bands of fine teeth in jaws and on palatines; none on vomer. Tongue long with rounded tip. Gill-membranes separated by narrow isthmus.

Body compressed, covered with embedded scales, in about 25 rows down the deepest part. Lateral line ascending sharply from behind head and

running along back close to dorsal fin. It commences as modified scales but terminates in a series of simple pores. Back above lateral line naked, body also scaleless around shoulder and pectoral bases.

No separate spine in front of dorsal fin. Dorsal spines not pungent. Dorsal fin originating over posterior part of head as a low fin which increases in height considerably before joining the rounded caudal. The rays are overlain with adipose tissue anteriorly, but become clear posteriorly, numbering about 70. Anal fin originating behind vent, in anterior half of fish, and continued, like the dorsal, to the caudal; it has about 43 rays. Pectorals broadly rounded, 19-rayed, middle rays longest. The pectorals are not united by membranes to the opercular lobe. Rays branched and with few articulations. Ventral fins jugular, each reduced to two small rays, the outer longer and thicker than the inner. Vent behind a plicate pouch.

General colour, dark chocolate, uniform and without spots, almost blackish except for the margins of dorsal, anal and caudal fins which are dull white. Pectoral and ventral fins and opercular membrane yellowish white. Eye bluish. Cheeks, behind mouth, crossed by two or three dark ocelli of irregular pear-shape margined with yellowish. A small ocellus on each side of barbel and a pair of larger ocelli on each side of chin below eyes. A faint ocellus 4 rays from end of dorsal.

Described and figured from the holotype of the species, a unique specimen, three inches long.

Locality.—Head of Useless Inlet, Shark's Bay, Western Australia; dredged on the pearl shell beds, in 2 or 3 fathoms, July 2, 1939, collected by G. P. Whitley. Austr. Mus., Regd. No. IB.344.

Named in honour of Mr. John Gregory, who greatly assisted me in his capacity as Fisheries Officer at Shark's Bay.

Family CARAPIDAE.

Genus CARAPUS Rafinesque, 1810.

CARAPUS RENDAHLI, *sp. nov.*

(Fig. 27.)

Fierasfer sp. Rendahl, Vidensk. Medd. Dansk. Nat. Foren., lxxxi., October 30, 1925, p. 13. From surface at 36° S. lat., 150° 20 min. E. long. ("Endeavour"), New South Wales.

Carapus sp. Whitley, Fish. N.S. Wales (McCulloch), Ed. 3, 1934, suppl. Off Green Cape, New South Wales.

Head (11 mm.), 8.4; depth (5) 18.5 in total length (93). Eye, 3 mm.; snout, 2; interorbital, 1; pectoral, 2.5; width of head, 4; length of upper jaw, nearly 6; predorsal length, 12.

Head somewhat compressed; snout broad, obtuse, with bony crests. Operculum with one or two weak spines. Posterior nostrils large, well separated from anterior. Eyes large, interorbital narrow with median crest. Upper jaw longer, reaching behind eye. A large canine on each side of both jaws anteriorly, lower ones longest. Other teeth in jaws in bands of fine villiform or minutely conic teeth. Coarser and rather granular teeth on vomer and palate. The median vomerine teeth are largest but none is caninoid. Gill-openings very wide, united across isthmus. Seven branchiostegals. Gill-rakers slender, not numerous.

Body elongate, compressed, not gibbous, the dorsal profile little more

arched than ventral. Vent far forward, below pectoral fin; a festoon of the intestine being external. A small point behind head indicates site of larval dorsal spine, now lost. The true dorsal fin originates shortly behind this and continues to end of tail, which is truncately broken off in my

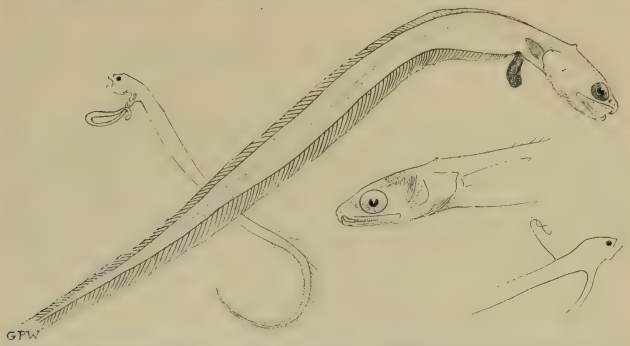

Fig. 27. Messmate Fish, *Carapus rendahli*. Holotype (central figure) and young stages from New South Wales. Semi-diagrammatic.

specimen. Anal fin many-rayed, like the dorsal, but higher, commencing behind vent. Pectorals small, pointed.

Colour, after long preservation in alcohol, yellowish-brown. Eye blue, canines white. Some spaced blackish chromatophores over brain and a few on snout and cheeks. Festoon of intestine blackish.

Described from the holotype of the species, an example 93 mm. or about $3\frac{3}{8}$ inches long.

Locality.—Port Jackson, New South Wales; purchased in January, 1889. Austr. Mus., Regd. No. I.2,411. No mention of its habitat is made.

I provisionally identify as belonging to this new species larval specimens from the following localities:—

Two specimens, noted by Dr. Hialmar Rendahl, from off the Tuross River, New South Wales; 36° S. x 150° 20 min. E., trawled by the "Endeavour". 28/9/1914. One was apparently lost with the "Endeavour", the other (of which Rendahl sent a sketch to McCulloch) is in the Riksmuseum, Stockholm.

One specimen from inside a large sponge, 22 miles N.E. from Green Cape, New South Wales; trawled in 39 to 46 fathoms. Austr. Mus., Regd. No. IA.1,958.

Many small examples in various stages of metamorphosis, netted by the C.S.I.R. vessel "Warreen" at the following stations:—

Station No.	*Position.*	*Date.*
59/38 ..	35° + S. x 150° 58 min. + E. ..	11/10/38
60/38 ..	36° 19 min. 40 sec. S. x 150° 24 min. 48 sec. E. ..	12/10/38
61/38 ..	36° 15 min. 40 sec. S. x 150° 15 min. 45 sec. E. ..	12/10/38
131/39 ..	30° 17 min. S. x 153° 16 min. 30 sec. E. ..	5/5/39

Station No.	*Position.*	*Date.*
266/39	36° 17 min. S. x 150° 25 min. E.	1/11/39
284/39	42° 35 min. S. x 148° 38 min. E.	12/11/39

All the above localities are in the Tasman Sea, off New South Wales, except the last, which is off eastern Tasmania.

Rendahl (Vidensk. Medd. Dansk. Foren., lxxxi., 1925, p. 13) recorded a *Fierasfer sp.* from Perseverance Harbour, Campbell Island, which may be allied or conspecific.

This new species differs from its Australian congeners as follows:— Differs from *Fierasfer houlti* Ogilby (Mem. Qld. Mus., vii., 1922, p. 301, pl. xix., fig. 1, from off Double Island Point, Queensland) in being much more slender and having different proportions in the parts of the head, also in having canine teeth. *Fierasfer margaritiferae* Rendahl (Kungl. Svenska. Vetenskaps. Handl., lxi., 9, 1921, p. 5, fig. 2, from Cape Jaubert, Western Australia) has similar dentition to mine but differs in proportions of head and body and has longer pectoral fins. *Oxybeles homei* Richardson (Zool. Voy. Erebus and Terror, Fish., 1846, p. 74, pl. xliv., figs. 7-19, from Timor) has enlarged teeth on vomer and jaws, quite unlike those of my specimen.

Family OPHIDIIDAE.

DANNEVIGIA, *gen. nov.*

Orthotype, *Dannevigia tusca,* sp. nov.

A genus of fairly large marine fishes with the ventral fins well forward on isthmus, body scaly, no barbels on head, and with dorsal, caudal and anal fins united. It is apparently closest to the European Cusk-Eel, *Ophidium;* but differs in having the scales in long longitudinal rows instead of in short criss-cross bars, in lacking enlarged teeth on the jaws, in proportions and other features. Other characters as described under species.

Named in honour of Harold Christian Dannevig, who was the founder of fisheries science in Australia. Born about 1860, near Arendal, Norway, Dannevig had a thorough practical fisheries training in Britain and Europe before coming to Australia in 1902, bringing live plaice from England, on the R.M.S. "Oroya". Though his acclimatization experiments came to nought, his work on Australian fresh and salt water fishes is of lasting value. In 1908 the Commonwealth appointed him Director of Fisheries for Australia. He planned the fisheries vessel "Endeavour" and directed its researches, and was lost at sea aboard that vessel when it disappeared without trace in December, 1914. None knew as well as he where our fishes could be caught and the best trawling-grounds. The fish described in this paper was discovered by him in March, 1913, when he wrote to the late A. R. McCulloch, ichthyologist at The Australian Museum, as follows:— "From its similarity with the European Tusk (*Brosmius*) I have entered it under that name in my notes. The specimens I sent are the smallest I could get. I have had them up to about 7 lb. in weight. I had one of these fish cooked and the flesh has a marked similarity to the European Cod, only it is a bit richer. I fancy I'll get them plentifully in 150-200 fathoms, where later on I'm going to try".

DANNEVIGIA TUSCA, *sp. nov.*

(Plate i., fig. 28.)

D., 103; A., 80; P., 24; V. 1. Sc. nearly 100. Tr. 11/1/32.

Head (96 mm.), 4.5; depth of body (85) 5.1 in total length (437). Eye

(17), 5.6; snout (27), 3.5; interorbital (25), 3.8 in head. Length of upper jaw (53), slightly shorter than pectoral fin (56). Longest ventral ray, 72 mm. Caudal, 23; depth of caudal peduncle, 5 mm.

Head deeper than wide and much longer than deep, rounded in front and oblong in transverse section behind. The snout ends in a skinny ridge, between the anterior nostrils, which has a slight median incision; below this ridge is a slight extension of the snout overhanging the premaxillaries. Nostrils two large oval openings on each side. Eye moderate, but covered with skin and its borders almost over-run by the longitudinal rows of scales which cover most of the head, except jaws and chin. No barbels or cirrhi. Mouth very large. Premaxillaries long, slender, protractile. Maxilla broad and large, scaly, reaching behind level of eye, its angle rounded and posterior margin truncate. Lips roughened at symphysis; lower lip finely plicate at sides. Lower jaw with elevated pad at ramus. Each jaw with a narrow band of fine, pluriserial, villiform teeth; upper jaw with, lower without symphysial diastema. A triangular patch of similar villiform teeth on vomer, and a lanceolate patch, tapering posteriorly, on each palatine. Pterygoids edentulous. Other patches of teeth on hyoid and pharyngeal bones. Tongue broad, acute, with rounded tip. Two bony frontal crests may be felt beneath the spongy skin of the interorbital. Preopercular margin free, with two divergent subdermal spines. Preorbital and all opercles entire. A pungent spine formed by operculum and overlapping the suboperculum. Nine strong branchiostegal rays, mostly exposed. Gill-openings wide, united across, and to, isthmus. Three long, stout gill-rakers on upper part of lower half of first branchial arch, preceded by a series of spinulose short blunt rakers dwindling anteriorly.

Body tapering, compressed, covered with thin, imbricate, cycloid scales, which also extend on to the fins. Their margins are ovate or lanceolate, most of them have a median ridge and they are disposed in long, waved, longitudinal rows. Between the scale-rows are sulci which emphasize their direction. Lateral line complete, originating just behind a pocket over the gill-opening and following the curve of the back along the sides to the tail, its course is marked by shallow troughs and spaced ridges, too irregular to be precisely counted. The extensions of the lateral line over the head are very indistinct. Pectoral axil naked. Vent moderate, before anal fin. No genital cage.

Dorsal fin originating slightly behind level of gill-opening and extending along back to join the caudal; it has about one hundred rays, closest together posteriorly, but these are invested with fatty tissue and a scaly sheath. Anal fin originating in anterior half of fish, similar to dorsal, with about eighty rays and likewise joined to the small rounded caudal fin. Pectorals broadly rounded. Ventrals jugular, each of one long bifid ray.

Colour, after long preservation in formalin, uniform light brown. Eye yellowish, pupil bluish. No colour markings, but the scales are densely dotted with brown chromatophores.

Described and figured from the holotype of the species, a specimen 437 mm. or about 17½ inches over all.

Locality.—Great Australian Bight, Western Australia; edge of bank, S.W. from Eucla; 80 to 120 fathoms; April, 1913. F.I.V. "Endeavour" collection (Holotype, registered No. E.3,508).

Six paratypes (E.2,336 to 2,338, E.3,506 and 3,507, and I.12,320) from the same locality, or nearby, in 70 to 120 fathoms, March and April, 1913.

The paratypes enable me to determine certain internal characters which are important for comparison with allied genera. In one of these (E.3,506), the tail had been lost, possibly through being bitten off by another fish; the dorsal and anal fins have grown around part of the stump and a false caudal fin of regenerated rays has been formed rather like the re-grown tail of some of the Macrurid fishes.

Premaxillary processes longer than eye. Maxillary with a large supplemental bone. The large pungent spine which protrudes over the suboperculum originates on the reduced operculum. More than fifty myotomes, sixteen of which are before the tail. Otolith nearly as long as eye.

Four actinosts at pectoral base, with lenticular interspaces.

The ventral fins are not attached to any of the hyal bones but appear to have a small pelvic girdle. Peritoneum dark brownish-grey inside, milky-blue externally. Numerous pyloric caeca. The air-bladder is long and bag-shaped, tough, and widest posteriorly, where there is an aperture.

A few nematodes in coelome. Sex apparently male. Sixty vertebrae.

Food: Mantis shrimps and crabs.

Family PLATYCEPHALIDAE.

Subfamily CYMBACEPHALINAE.

Genus CYMBACEPHALUS Fowler, 1938.

Cymbacephalus Fowler, Proc. U.S. Nat. Mus., lxxxv., 1938, p. 90. Orthotype, *Platycephalus nematophthalmus* Günther.

CYMBACEPHALUS NEMATOPHTHALMUS (Günther, 1860).

Head moderately depressed, with ridges and spines and small scales. No radiating cranial ridges. Interorbital strongly excavate with several spines on its ridges posteriorly. A shallow pit behind each eye, the latter large, elliptical. Several conspicuous dermal flaps over eye and a tentacle on lower eyelid. Side of head unicarinate; infraorbital ridges spineless, the cheeks bulging below them. Nostril flaps small. Two very short, blunt, spaced preopercular spines, mostly covered by skin, and a vestige of a third lower spine; no antrorse spines. Teeth mostly villiform on jaws, vomer and palatines, but some are cardiform anteriorly; no enlarged canines.

Some dimensions, in mm., are: Head, 95; depth, 30; standard length, 215; horizontal diameter of eye, 17; vertical do., 14.5; interorbital, 7; depth of caudal peduncle, 10.

Body not elongate, depressed anteriorly and compressed behind caudal peduncle. Skin leathery; body with large cycloid scales. About fifty somewhat enlarged lateral line scales, none of them with upstanding spines; no bucklers. Fins as in flatheads generally. D.viii., 11; A., 11. Membranes extending to near tips of spines and rays.

Colour yellow above, whitish below. Some rusty oblique lines on fins, a few diffuse spots on head, and ill-defined orange bars on body anteriorly. Apparently no dark border to anal fin and only the very tips of the lower caudal rays fuscous.

Described from a specimen 215 mm. in standard length or ten inches over all. Austr. Mus., Regd. No. IB.470.

Locality.—Outer harbour, Albany, Western Australia; presented by Mr. A. J. Fraser, Chief Inspector of Fisheries, Perth, W. Australia.

New record for Western Australia.

Family Antennariidae.

Lophiocharon goramensis (Bleeker, 1864).

(Plate ii., fig. 29.)

Antennarius goramensis Bleeker, Nat. Tijdschr. Dierk., ii., 1864, p. 177, and Atlas Ichth., v., 1865, p. 17, pl. cxcv., fig. 2. Goram, Moluccas. *Id.* Günther, Journ. Mus. Godeff., xi., Fische der Sudsee, v., 1876, p. 164, pl. c., fig. B (as *A. commersonii*, var., from Raiatea).

D. iii., 13; A., 9; P., 11; V., 5; C., 9.

Head (67 mm.), 3.1; depth (167) 1.2 in standard length (210). Eye very small, an oblique ellipse, 7 mm. long, less than gill-opening (10). Upper jaw 62 mm. Low jaw jutting prominently. Preorbital overhanging premaxillary superiorly. Maxillary extensive, its end rounded. Several rows of backwardly-directed small canines on jaws, vomer, palatines and pterygoids and a patch on each side of tongue. Chin rounded, protruding. Pharynx plicate, greatly distensible. Nostrils elongate, slit-like.

Form very deep, somewhat compressed, subelliptical in transverse section, its width less than half its depth; upper profile gibbous, lower convex, the body being covered with baggy integument densely covered with a pile of short prickles. The latter are mostly bifid but some are trifid and a few are enlarged, notably in groups on hummocks at intervals along the lateral line system (notably along back, around operculum and chin, and behind maxillaries), where there may be a digitiform or filamentous cutaneous flap amongst the spines on the hummocks. No warts.

A naked patch of skin, but no sunken area, on each side of second (frontal) dorsal spine. Illicium long and filamentous, unfortunately incomplete in this specimen, at least 53 mm. long, and thus longer than frontal and occipital dorsal spines. Second dorsal spine much shorter and straighter than third, both connected by membrane to back.

Dorsal rays about equal to third dorsal spine, but the lengths are difficult to determine without dissecting away integument and basal tissue. Anal base less than half that of soft dorsal. Outlines of fins broadly rounded with ends of rays protruding bluntly. Most of the fin rays are simple, but some of the median rays of the unpaired fins are bifid. Ventral fins very short and broad.

Ground colour blackish, densely overlain by irregular patches of pink which are largest on sides of head, nape, flanks, and caudal base. Also irregularly disposed, but roughly conforming to the lateral line system, are series of greyish-brown lichen-like patches. Maxillary, inside of mouth, and chin brownish to brownish-grey with irregular cream lines. Vent and tips of fin-rays whitish. The whole coloration must resemble weed-covered rock to an extraordinary degree and effectively camouflage the living fish. The eye is almost invisible, being blended with the general colour-patterns. In spite of their irregular nature, the markings are fairly symmetrical on each side of the fish. No ocelli, though there are dusky patches on dorsal and anal bases. Illicium horn-yellowish with brown rings.

Described and figured from a specimen nearly one foot over all (Austr. Mus., Regd. No. IA.5,824).

Locality.—Off Cairns, north Queensland; 24 fathoms. Presented by Dr. P. S. Clarke in June, 1933. The circumstances of its capture were unusual,

the donor stating: "A Queensland Groper [*Promicrops lanceolatus*] weighing about two cwt. was caught on a fishing line when fishing at a depth of 24 fathoms. As soon as the Groper was landed on the deck it vomited the Angler Fish, which latter was alive at the time. Charles Jorgensen was the fisherman who caught the groper".

New record for Queensland. Extralimital in East Indies and Oceania.

Differs from *Antennarius* [= *Lophiocharon*] *goramensis*, as described and figured by Bleeker, in having the back more elevated, the occipital dorsal spine being higher than anterior dorsal rays, the distance from snout to origin of soft dorsal fin is subequal to that from origin of soft dorsal fin to roots of caudal rays, and in lacking the black ocelli, but these differences are probably due to ordinary variation.

From the genotype, *Lophiocharon broomensis* Whitley (Rec. Austr. Mus., xix., 1933, p. 104, pl. xv., fig. 1. Broome, Western Australia), *L. goramensis* differs in having teeth on vomer and on each side of tongue, dorsal spines more separated from one another and from soft dorsal fin, more pectoral rays, gill-openings greater than eyes, and in coloration.

ANTENNARIUS ASPER Macleay, 1881.

(Plate ii., fig. 30.)

Here figured from a specimen, nearly 4 inches long, from Murray Island, Queensland, which is very near the type locality, Darnley Island.

Austr. Mus., Regd. No. IA.3,718.

The rough skin, yellowish coloration, and black rings on the caudal membranes are characteristic.

HISTIOPHRYNE BOUGAINVILLI (Cuv. & Val., 1837).

(Fig. 31.)

This little Angler Fish was first discovered by Baron Bougainville's expedition, which may have dredged it at Sydney, though no type-locality was given. McCulloch and Waite (Rec. S. Austr. Mus., i., 1918, p. 72, pl. vii., fig. 1) figured it from South Australia, but it is also found well to the north and Waite (Rec. S. Austr. Mus., ii., 1924, p. 486) recorded it from Port Stephens, New South Wales, but the Australian Museum has since received specimens from Woy Woy, New South Wales, and Heron Island, Queensland—a new record for the latter State. The Woy Woy example is very bloated and its fins are abraded through its having been washed up on the ocean beach; standard length, 41 mm.

Its colours, when fresh, were bright yellow with faint greyish reticulations and a few large irregular rusty patches on sides and behind pectorals; eye green.

The small Queensland specimen may be described as follows:—

D. iii., 15; A., 8; P., 8; V., 5; C., 9.

Head (9 mm.), 2.6, depth (15) 1.6 in standard length (24). Width of head, 8 mm.; maxillary, 3.75; eye, 2 mm.; interorbital, 3; snout, 1.5; illicium, 2.5; depth of caudal peduncle, 3.5; preanal length, 16; base of soft dorsal (from first to last ray), 16; base of anal, 6.

Upper profile of head much steeper than lower, the head being higher than long. Maxilla narrow, just reaching below eye, and before a hump on the cheek. Head with series of paired flaps along mucous canal system.

Anterior nostrils bell-like, opening forwards; posterior nostrils smaller, opening upwards. Lower lip coarsely crenulated. Patches of villiform teeth on jaws and tongue. Chin prominent. Gill-opening in a small tube behind pectoral.

Skin smooth. Form elevated, compressed, back strongly arched, belly concave. The lateral line descends sharply behind the pectoral fin to the posterior anal rays. Illicium short with a club-like, truncated tip. Second

Fig. 31. Smooth Angler Fish, *Histiophryne bougainvilli*. Heron Island, Queensland.

dorsal spine also short, joined to third by membrane; the third spine is likewise connected to first dorsal ray. Length of dorsal rays increasing towards rear of fin. Anal rounded, its rays longer than the dorsal ones. Dorsal, anal and the rounded caudal joined by membranes. Most caudal rays branched. Pectorals of the usual elbowed type. Ventrals stubby, curled outwards.

General ground colour in formalin pale brownish-pink on head, body, and fins. Close-set pale brown mottlings on sides of head and body, or radiating from eye, the most conspicuous being three or four large clusters forming darker blotches along back below soft dorsal fin. Inner part of "wrist" with a dark greenish band. A small barnacle-like spot in pectoral axil. Tips of paired fins mottled brownish. Caudal with pink blotches. Eye pale green, pupil black.

Locality.—Heron Island, Queensland; in clump of coral (Regd. No. IB.771). Probably the coloration imitates, to some extent, the coral hiding-place.

Described from a specimen 24 mm. in standard length or $1\frac{3}{8}$ inches over all, obtained by Mr. A. A. Cameron, of Harwood Island, New South Wales, who has collected many interesting marine animals in Queensland and northern New South Wales.

Family TRIACANTHIDAE.

TRIACANTHUS FALCANALIS Ogilby, 1910.

(Fig. 32.)

Here figured from the smallest of Ogilby's co-types in the Queensland Museum, the lectotype, 191 mm. in standard length or about 9½ inches over all.

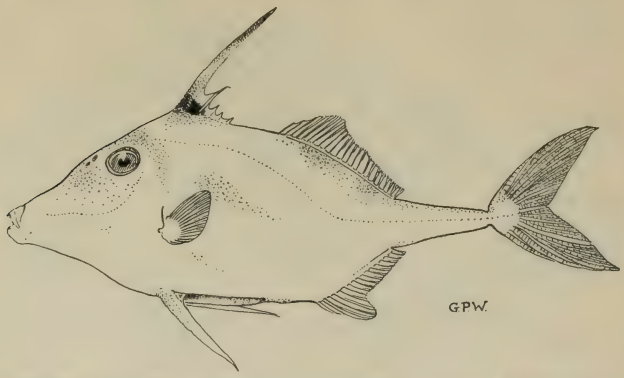

Fig. 32. Tripod Fish, *Triacanthus falcanalis*. Lectotype, Moreton Bay, Queensland.

This species may now be added to the New South Wales fauna, as Mr. G. Kesteven collected a young example in Terranora Lakes, Tweed River (Austr. Mus., Regd. No. IB.1,005).

Family BALISTIDAE.

Genus ABALISTES Jordan and Seale, 1906.

ABALISTES STELLATUS (Anon), var.

Balistes stellatus Anonymous, Allgem. Lit.-Zeitung, iii., 287, September 24, 1798, p. 682. Based on "Le Baliste étoilé" Lacépède, Hist. Nat. Poiss., i., 1798, p. 350, pl. xv., fig. 1, vernac. Indian Sea. *Id.* Daudin, Dict. Sci. Nat., iii., 1804, p. 474. *Id.* Günther, Cat. Fish. Brit. Mus., viii., 1870, p. 212 (Hope Is. and W. Austr., etc.). *Id.* Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Phil. Exhib.), 1875, p. 49 (Qld.). *Id.* Rendahl, K. Svenska Vet. Akad. Handl., lxi., 9, 1921, p. 23, fig. 7 (Cape Jaubert, W.A.).

Balistes stellaris Bloch and Schneider, Syst. Ichth., 1801, p. 476. On Lacépède, *l.c.*

Leiurus macrophthalmus Swainson, Nat. Hist. Fish. Amphib. Rept., ii., July, 1839, p. 326. On Russell, Fish. Vizag., 1803, pl. 22. Vizagapatam.

Leiurus russellii Swainson, *ibid.*, p. 326. On Russell, pl. 23, Vizagapatam (Swainson's copy in Austr. Mus. lib.).

Balistes phaleratus Richardson, Discov. in Austr. (Stokes), i., 1846, p. 484, pl. i., figs. 4-5 (young). West coast of Australia. Type in British Museum.

? *Balistes vachelli* Richardson, Zool. Sulphur., 1845, p. 129 (young). Canton.

Balistes phalliatus Bleeker, Atlas. Ichth., v., 1869, p. 106. Error for *phaleratus*, in synonymy of *Leiurus stellatus*.

Abalistes stellaris Jordan and Seale, Bull. U.S. Bur. Fish., xxv., 1905 (1906), p. 364, and of modern authors.

Abalistes stellaris var. *phaleratus* McCulloch, Rec. W. Austr. Mus., i., 3, 1914, p. 227 (Port Hedland, W.A.).

A fine specimen, 19 inches long, was caught off the Prince Henry Hospital, Little Bay, near Sydney, New South Wales, on 23rd April, 1940, and presented to the Australian Museum by Mr. W. Jones (Regd. No. IB.506).

New record for New South Wales.

The Australian Museum has specimens from McCulloch Reef, Great Barrier Reef, Queensland (W. E. Paradice); Port Hedland, north-west Australia (W.A. Mus.) form *phaleratus;* Hervey Bay district, Queensland (Dr. Lockwood); and Madras, India (F. Day).

Habitat.—W. Australia, Queensland, New South Wales, East Indies, India, Philippines, Pacific and Indian Oceans, South Africa, Red Sea.

The type may have come from Mauritius or India and the New South Wales specimen does not agree perfectly with the original description and figure, so may require a new subspecific name.

However, in view of known variation in file fishes, it may be left in abeyance for the time being.

Family Aleuteridae.

Blandowskius bucephalus Whitley, 1931.

Blandowskius bucephalus Whitley, Austr. Zool., vi., 4, February 13, 1931, p. 329, pl. xxvi., fig. 1. Off Wilson's Promontory, Victoria.

Messrs. Hugh Ward and Knud Moller have trawled several examples of this species in 35 to 70 fathoms off Eden—a new record for New South Wales.

These specimens, up to 4 inches over all, show that the head of the holotype was abnormal, for in these the profile is sloping and either gently convex or excavated before the eyes. The bluish spots are very regular. The dorsal spine is straight, or curved backwards, and is armed with four rows of spines.

Family Molidae.

Genus Mola Cuvier, 1798.

Mola ramsayi (Giglioli, 1883).

Orthragoriscus ramsayi Giglioli, Nature, xxviii., August 2, 1883, p. 315. Sydney.

Mola ramsayi Whitley, Rec. Austr. Mus., xviii., 1931, p. 126, pl. xvi., figs. 1, 3 and 4, and text-fig. 2 (refs. and synon.). *Id.* Griffin, Ann. Rept. Auckland Mus., 1931, pp. 13 and 37 (10 cwt., N.Z. specimen). *Id.* Schmidt, Dana's Togt. omkring jorden, 1932, p. 249, et seq., fig. 193. *Id.* Whitley, Vict. Naturalist, xlix., 1933, p. 210, figs. 1-2 (Lord Howe Is. juvenile). *Id.* Stead, Giants and Pigmies, 1933, p. 72 and figs.

Since 1931, when I issued a list of all the known Australasian occurrences of the Ocean Sunfish, several more specimens have come to light. Griffin (loc. cit.) refers to a 10 cwt. New Zealand specimen in 1931. On May 17, 1932, a sunfish, 7 ft. 4 in. long, was washed ashore at Bulli, New South Wales. A sunfish was caught at Point Piper, Port Jackson, on October 18, 1934. Then at the Eight-hour Day week-end, October 7, 1936, a large specimen was caught at Watson's Bay and kept in captivity for a few days at Manly Aquarium. A sunfish was caught with rod and reel near Bermagui, New South Wales, January 26, 1937. The *Auckland Weekly News* of April 7, 1937, figured another *Mola*, "stranded last week" at Onehunga Wharf, Auckland, New Zealand; it measured 3 by 4 feet and weighed about 150 lb. A large one, 11 ft. 4 in. between fin-tips, was found at Catherine Hill Bay, New South Wales, in February, 1938. A New Zealand example, 4½ by 8 ft., was caught on a snapper line at Gisborne, New Zealand, in October, 1938.

The description of a "sunfish" from the Grafton district, New South Wales, published in the press early in 1939, obviously referred to a Devil Ray (*Daemomanta*). Finally, on February 26, 1939, a small sunfish was caught above the bridge at Roseville, near Sydney, New South Wales, in shallow water, miles from the open sea. Fortunately, Dr. H. C. Raven, of the American Museum of Natural History, was in Sydney, and we examined and dissected the specimen for comparison with Gregory and Raven's account of the anatomy of *Mola mola* in Copeia, 1934, 4, p. 145 and plate. The Roseville specimen agreed very closely with the American one in anatomical features. It was a young female, 5 ft. 7 in. in total length; the liver was very worm-infested and the alimentary canal, which measured 14 feet from the pharyngeal teeth to the anus, contained no food.

There were a few strips of Zostera-weed in the pharynx. The oviduct was preserved, also the pharyngeal teeth (Austr. Mus., Regd. No. IA.8,035). About 15 dorsal and anal rays and 12 pectoral could be counted exteriorly.

Dimensions: Total length, 67 inches; depth of body, 38; between dorsal and anal fin-tips, 87; head, 18½; snout, 8½; eye, 2½; gill-opening, 4; pectoral base, 5½; length of pectoral fin, 10⅜.

Another sunfish was stranded at La Perouse, Botany Bay, on September 9, 1940, but had been towed to sea before I could examine it.

A BASIC LIST OF THE LAND MOLLUSCA OF PAPUA.

By Tom Iredale.

(*Contribution from the Australian Museum, Sydney, New South Wales.*)

(Plates iii. and iv.)

The occurrence in North Queensland of land mollusca of undoubted Papuan relationship necessitated criticism of Papuan material. The Rev. H. T. Williams, a few years ago, brought in a series of shells from the Trobriand Islands, and these were set on one side, the nature of the fauna being at that time unfamiliar. Recently, the Rev. H. K. Bartlett presented a series from Misima (St. Aignan) and other islands of the Louisiade Group, and has undertaken the collection of more material. The time, therefore, becomes opportune to bring the data regarding the Papuan fauna into line with that of Australia, as nothing is available since Hedley's list fifty years ago. My talented predecessor, Charles Hedley, initiated his brilliant malacological career with a study of the Papuan Land Mollusca, having made a large collection himself, and this local knowledge counteracted his lack of experience. Since his list was prepared small collections have come to hand, and these are here brought under review, but the present List must be regarded as purely a basic effort, our knowledge of the vast area being still very slight. It has been a difficult task even to compile such a list as many species were described as from "New Guinea", an absolutely meaningless term, considering the size of that huge island, with the fact that there are three different faunal areas included in the island. Although at one time Papua was used for the whole island, this is now the official name of the south-eastern portion only, formerly known as British New Guinea; to the west is Dutch New Guinea and to the north is the Territory of New Guinea, formerly known as German New Guinea. Hedley wrote "(Papua) comprises the south-eastern quarter of (New Guinea) with the adjacent reefs and islands, except those falling within the Queensland boundary, between the meridians of 141° and 155° of E. Long., and the parallels of 8° and 12° of S. Lat. Though these political boundaries do not form the natural limits of the fauna. . . . The land shells of the province exhibit four rather distinct geographical divisions:—(a) The alpine fauna. (b) That region lying between Port Moresby and the Fly River. (c) South Cape Island, and includes all the eastern extremity of New Guinea with the outlying islands adjacent, and (d) The Louisiade, Dentrecasteaux, Trobriand and Woodlark Archipelagos".

Collections now available show that the last three merge, while the alpine fauna is still unknown, and that, contrary to Hedley's conclusion, the political boundaries in this case coincide quite closely with the natural distribution of the fauna. Thus the western fauna flows down the north coast, and a few species penetrate into Papua, but these are easily recognisable, while on the other hand only a very few of the western Solomon Island groups reach into the eastern limits of the Papuan island appanages.

It may be noted that some sixty years ago, Tapparone-Canefri listed the land and freshwater molluscs of New Guinea, and only two hundred and nine species of land shells were recognised. Hedley gave a review of the collectors up to 1890, and since then only desultory collections have

been made, none of much extent. Over one hundred years ago, G. B. Sowerby, Jr., wrote (Conch. Man. Introd., p. v., 1839): "Let none be discouraged by the number of generic distinctions created in modern times; for, if well defined, they will be found to facilitate rather than encumber the study. The knowledge of species must be the foundation of every system, and the greater the number of species, the greater is the necessity for systematic distinctions. . . . Every well marked division, however arbitrary its limits, tends to simplify the subject, and to facilitate the researches of the student".

Now there has just come to hand an excellent list of British Non-Marine Mollusca, by A. S. Kennard, and therein it is noted that the true Helicids, only twenty-three species, are separated into no fewer than sixteen genera. How many divisions will later be utilised in connection with this and the Australian Land Mollusca cannot even be guessed at, especially as these localities incorporate distinct faunal elements, and the fauna is not in any sense homogeneous, as the British Land Mollusca is. Anatomical study will apparently be responsible for much of the splitting, as evidenced by the recent account of Zonitid Shells from the Pacific Islands, by Burrington Baker, wherein the only blot appears to be due to the struthionine subterfuge of the nomination of subgenera extensively. When the shells so differentiated are examined by a conchologist it becomes evident that much more splitting must be undertaken by the latter to keep abreast of the anatomist. It also seems evident that unless the anatomist has a lead from the conchologist he is generally unable to form any definite conclusion as to the relationship of the molluscan animal he has so meticulously dissected.

Class GASTROPODA.

Subclass PROSOBRANCHIA.

Order PECTINIBRANCHIA.

Family HYDROCENIDAE.

Genus DRAMELIA *nov.*

Type, *Realia isseliana* Tapparone-Canefri.

Shell very small, conical, perforate, whorls rounded, mouth subcircular, almost free. The generic name *Realia* cannot be maintained here as it is the correct name for a group, usually called *Omphalotropis*, as hereafter shown. The Neozelanic group recently known as *Realia* will bear the name *Liarea*, and this has nothing to do with the present species.

DRAMELIA ISSELIANA Tapparone-Canefri, 1883.

1883. *Realia isseliana* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 271, pl. 10, figs. 12-13 (dated July 14). Wokan Is., Aru.

This has been recorded from the Purari Valley, Papua.

Family HELICINIDAE.

Many forms of Helicinids have been recorded under the generic name *Helicina*, and through this lumping usage there has been great confusion of species. An attempt is here made to group them more accurately, but owing to the very poor monographic accounts available, this is open to later emendation, and many more species will be added.

Wagner's Monograph is so inaccurate that it is more troublesome than useful, as evidenced by the omissions pointed out by Fulton (Proc. Malac.

Soc. (Lond.), Vol. xi., pp. 237-241, March 29, 1915, and id. ib., pp. 324-326, August 20, 1915).

Genus Palaeohelicina Wagner, 1905.

1905. *Palaeohelicina* Wagner, Denkschr. k. akad. Wissen. Wien., Math.-Nat. Class, Vol. lxxvii., p. 435. Logotype, Ired., Austr. Zool., viii., p. 292, 1937. *H. fischeriana* S. & M.

1905. *Rhabdokonia* id. ib. Same type.

Palaeohelicina fischeriana Souverbie & Montrouzier, 1863.

1863. *Helicina fischeriana* Souverbie & Montrouzier, Journ. de Conch., Vol. xi., p. 76, January 1; id., p. 171, pl. 5, fig. 3, April 1. Woodlark Is.

1866. *Helicina carinifera* Sowerby, Thes. Conch., Vol. iv., p. 295, fig. 431 (as *carinata* Orbigny)). Woodlark Is.

1873. *Helicina carinifera* Sowerby, Conch. Icon. (Reeve), Vol. xix., pl. xxvii., p. 241 (as of Orbigny), December. Woodlark Is.

Palaeohelicina insularum Hedley, 1891.

1891. *Helicina insularum* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 113, pl. xii., bis., fig. 44, September 9. Sudest Is., Louisiades.

1905. *Palaeohelicina fischeriana lampra* Wagner, Denkschr. akad. Wissen. Wien., Vol. 77, p. 436. Louisiades (as synonym Wagner, Syst. Conch. Cab. (cont. Kuster), Bd. I., Abth. 18, p. 246, 1909.

Palaeohelicina congener Smith, 1889.

1889. *Helicina congener* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 203, pl. 13, fig. 17, September. Misima, Louisiades. The figure of *Helicina tecta* Sowerby, Thes. Conch., Vol. iii., p. 295, fig. 434, 1866, is suspiciously like this species.

Palaeohelicina phronema Wagner, 1905.

1905. *Palaeohelicina fischeriana phronema* Wagner, Denkschr. akad. Wissen. Wien., Vol. 77, p. 436, pl. ix., figs. 11a, b, c. Fergusson Is.

1909. *Palaeohelicina fischeriana elegans* Wagner, Syst. Conch. Cab. (Mart. & Chemn.), cont. Kuster, Bd. I., Abth. 18, p. 245, pl. 48, fig. 13. Fergusson Is. (*phronema* figd. id. ib., pl. 48, figs. 11-12).

Palaeohelicina novoguineensis Smith, 1887.

1887. *Helicina novoguineensis* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 425, pl. 15, figs. 11, 11a, June. Foot of Owen Stanley Mountains, New Guinea: id. ib., Ser. 6, Vol. iv., p. 203, pl. 13, fig. 17.

Palaeohelicina vocator *sp. nov.*

Specimens from Maneao, N.E. Papua, are true *Palaeohelicina*, differing in form from the nearest species, *P. phronema*, being 16 mm. broad by 12 mm. high, instead of 20 mm. by 14 mm., with much coarser sculpture. The coloration is that typical of the genus, but the red markings are not very pronounced.

Genus Kalokonia Wagner, 1909.

1909. *Kalokonia* Wagner, Syst. Conch. Cab. (Mart. & Chemn.), cont. Kuster, Bd. I., Abth. 18, p. 238, dated 15/6/1909. Type, here selected, *Helicina moquiniana* Recluz.

Kalokonia louisiadensis Forbes, 1851.

1851. *Helicina louisiadensis* Forbes, Voy. Rattlesnake, Vol. ii., p. 382, pl. iii., figs. 5a-b., "1852" = December, 1851. Round Is., Coral Haven, Calvados Chain.

KALOKONIA WOODLARKENSIS Smith, 1891.

1891. *Helicina woodlarkensis* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. vii., p. 138, January. Woodlark Is. Paratype figured by Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 114, pl. xii., bis., fig. 46, 1891.

Genus SPHAEROCONIA Wagner, 1909.

1909. *Sphaeroconia* Wagner, Syst. Conch. Cab. (Mart. & Chemn.), cont. Kuster, Bd. I., Abth. 18, p. 189 (dated January 25). Logotype (Ired., Austr. Zool., viii., p. 292, 1937), *Helicina sphaeroconus* Möllendorff.

SPHAEROCONIA STANLEYI Forbes, 1851.

1851. *Helicina stanleyi* Forbes, Voy. Rattlesnake, Vol. ii., p. 381, pl. 3, figs. 4a-b, "1852" = December, 1851. Duchateau Is., Louisiades.

Note: Wagner (Denkschr. akad. Wissen. Wien., Vol. 77, p. 438, pl. ix., figs. 17a-b, 1905) described and figured specimens from Mailu, north of Orangerie Bay, Papua, under this name, tall banded specimens, measuring 6.2 mm. x 4.4 mm., and this mainland form may be called *Sphaeroconia superflua* sp. nov.

SPHAEROCONIA ROSSELENSIS Hedley, 1891.

1891. *Helicina rosselensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 113, September 9. Rossel Is., Louisiades.

1909. *Palaeohelicina stanleyi rosselensis* Wagner, Syst. Conch. Cab. (Mart. & Chemn.), cont. Kuster, Bd. I., Abth. 18, p. 251, pl. 50, fig. 23 (dated May 4).

1905. *Palaeohelicina filiae* Wagner, Denkschr. akad. Wissen. Wien., Vol. 77, p. 439, pl. ix., figs. 14a, b, c. "Louisiades" = Rossel Is.

SPHAEROCONIA TROBRIANDENSIS Hedley, 1891.

1891. *Helicina trobriandensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 113, September 9. Trobriand Is.

SPHAEROCONIA MURUENSIS Hedley, 1891.

1891. *Helicina muruensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 113, September 9. Woodlark Is.

SPHAEROCONIA EDUARDI Wagner, 1905.

1905. *Aphanoconia eduardi* Wagner, Denkschr. akad. Wissen. Wien., Vol. 77, p. 393, pl. iv., figs. 17a, b, c. Louisiades = Sudest Is., fide Conch. Cab., Bd. I., Abth. 18, p. 203, 1909.

SPHAEROCONIA SINUS Hedley, 1891.

1891. *Helicina sinus* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 113, pl. xii., bis., fig. 45, September 9. Mita, Milne Bay, Papua.

SPHAEROCONIA DENTONI Pilsbry, 1890.

1890. *Helicina dentoni* Pilsbry, Proc. Acad. Nat. Sci. Philad., 1890, p. 186, July 29. British New Guinea (Denton) = Port Moresby district.

1887. *Helicina solitaria* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 425, pl. 15, fig. 10, June. Foot of Astrolabe Mountains; refigured from Eafa district, 5,000-6,000 ft., Smith, Journ. Malac., Vol. v., p. 22, pl. ii., fig. 15, 1896. Not *Helicina solitaria* C. B. Adams, Pr. Bost. Soc. N.H., p. 12, 1845.

1906. *Palaeohelicina hara* Wagner, Denkschr. akad. Wissen. Wien., Vol. 78, p. 204, pl. x., figs. 18a, b, c. British New Guinea.

SPHAEROCONIA COXENI Brazier, 1876.

1876. *Helicina coxeni* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 111, July

2. Yule Is. Figd. Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 274, fig. g in text, and pl. ix., figs. 12-13, 1883.

SPHAEROCONIA MAINO Brazier, 1876.

1876. *Helicina maino* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 115, July. Katow, Brit. New Guinea. Type figured by Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 115, pl. xii., bis., fig. 47, 1891.

SPHAEROCONIA REGESTA *sp. nov.*

Nearest *S. coxeni* Brazier, geographically, but smaller, flatter and with coarser sculpture, twelve ridges on the last whorl above the periphery, while there are about twenty on *coxeni*, the ridges also being more regularly spaced. The type from Purari Valley, Papua, measures 12 mm. broad and 8 mm. high. The colour is pale creamish with the apical whorls lemon yellow.

Genus NEGOPENIA *nov.*

Type, *Negopenia leucostoma idesa* subsp. nov.

This peculiar little Helicinid has an elevated spire, whorls smooth, convex, mouth not very oblique, angulate at the columella, umbilical pad small and finely punctate, operculum thin, a little concave externally.

NEGOPENIA LEUCOSTOMA IDESA *subsp. nov.*

Tapparone-Canefri (Ann. Mus. Civ. Genova, Vol. xix., *H. leucostoma*, p. 277, fig. in text, 1883 (dated July 14)), described and figured *Helicina leucostoma* from New Guinea, and Hedley recorded it from Purari Valley, Papua. The latter specimen, while apparently congeneric and conspecific, differs a little in size, the striation obsolete, measuring 5 mm. by 5.5 mm., the spire broader and the sutures less impressed.

Genus PECOVIANA *nov.*

Type, *Helicina multicoronata* Hedley.

The bristly periostracum differentiates this from all other local Helicinids, and is associated with smooth callus, with operculum with almost central nucleus; the small size and globosely conical form also separate it from other Papuan groups.

PECOVIANA MULTICORONATA Hedley, 1891.

1891. *Helicina multicoronata* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 115, pl. xii., bis., fig. 48, September 9. Mita, Milne Bay, Papua.

Hedley also recorded this species from the Purari Valley, which suggests that the genus is widely spread in Papua.

Note: Many queries still persist in the determination of Helicinids through locality and other errors. Thus *Helicina suprafasciata* was described by Sowerby (Conch. Icon. (Reeve), Vol. xix., pl. 30, sp. 300, February, 1874, from Australia), and Hedley reported that Smith, from comparison of the type, had identified it as *insularum*, and that Australia was thus incorrect. He added a tale from Brazier as to the comparison, but the description and figure do not agree with *insularum*, being more like that of the *sinus* series. Wagner omitted the species altogether, so that until the group is studied more accurately, the name *suprafasciata* can be omitted from this faunula. Again, *Sulfurina* was proposed by Möllendorff, Ber. Senckenb. Ges., p. 141, June-October, 1893, with orthotype, *Helicina citrina* Grateloup, measuring 14.5 mm. by 8.5 mm., from the Is. of Luzon, Philippines.

Genus PESTOMENA *nov.*

Type, *Sulfurina jickelii* Wagner.

This small shell, measuring 3.5 mm. by 2.2 mm., was noted by Wagner himself as not a typical *Sulfurina*, being more globose, the whorls more convex, the basal angulation obsolete and the sculpture a little reticulate.

PESTOMENA JICKELII Wagner, 1905.

1905. *Sulfurina jickelii* Wagner, Denkschr. akad. Wissen. Wien., Vol. 77, p. 381, pl. iv., figs. 1a, b, c. Stirling Range, Brit. New Guinea.

Family CYCLOPHORIDAE.

Thiele's family of this name is a curious agglomeration of true Cyclophorids, many pseudo-Cyclophorid groups with Pupinids and Diplommatinids and a few other series. The family name is here used for the restricted Cyclophorus-like forms.

Genus LEPTOPOMA Pfeiffer, 1847.

1847. *Leptopoma* Pfeiffer, Zeitschr. für Malak., 1847, p. 47, March. Logotype, Kobelt. Illustr. Conchylienbuch, p. 194, 1878, *Leptopoma vitreum* Lesson, s. *nitidum* Sowerby.

1855. *Dermatocera* H. and A. Adams, Gen. Rec. Moll., Vol. ii., p. 282, November. Logotype, *Leptopoma vitreum* Lesson.

LEPTOPOMA NITIDUM Sowerby, 1843.

1843. *Cyclostoma nitidum* Sowerby, Thes. Conch., Vol. i., p. 133, pl. xxix., figs. 225-227, ante June 23. Is. of Guinaras and Zebu, Philippine Islands.

Many forms of this style will later be differentiated as series show local variation. This is the group known as *vitreum* Lesson, but Lesson's choice was invalid through preoccupation.

Thus a series from Misima is composed of large broad shells, measuring 18 mm. in breadth, by 19.5 mm. in height, whilst in another from Tube Tube, Engineer Group, the average is 15 mm. broad by 17 mm. high, the smaller one showing more peripheral keeling and much stronger sculpture. These may be named as *L. n. sanctum* subsp. n., and *L. n. faber* subsp. n., respectively as a beginning.

LEPTOPOMA GIANELLII Tapparone-Canefri, 1886.

1886. *Leptopoma gianellii* Tapparone-Canefri, Ann. Mus. Civ. Genova, Ser. 2, Vol. iv., p. 183, pl. 2, figs. 10-11 (dated July 6). Katau, Papua.

From the Purari Valley a similar specimen, measuring 10 mm. by 10 mm. has the form and horny operculum of *Leptopoma*, being subkeeled peripherally, the last whorl sculptured with rather distant delicate ridges, six or seven on the penultimate and antepenultimate, the apical whorls being similarly sculptured, red in colour, the body colour being fawn, mottled with darker.

This must be called *Leptopoma injectum* sp. nov.

Genus ETTEMONA *nov.*

Type, *Ettemona perspicua* sp. nov.

From the Purari Valley a shell of the same size as the preceding appears comparatively taller superficially, the whorls shouldered with the last whorl distinctly peripherally keeled, the base somewhat flattened, the umbilicus narrow, mouth almost circular, free, lip duplicate all round, sculpture of bristly ridges, the shoulder bearing three minor ridges, the base

showing a dozen finer ridges, the intervening part of the whorl with four strong ridges, coloration brown, apical whorls black. The operculum is circular, thin, horny, many whorled, the edges of the whorls slightly fringed. Recorded by Hedley (Proc. Linn. Soc. N.S.W., Ser. 2, Vol. ix., p. 386, pl. xxiv., figs. 2-4, December 10, 1894), under the name *Lagocheilus poirierii*, which only measures 7 mm. by 7 mm., with operculum unknown.

ETTEMONA POIRIERII Tapparone-Canefri, 1883.

1883. *Cyclotus* ? *poirierii* Tapparone-Canefri, Ann. Mus. Civ. Genov., Vol. xix., p. 254, pl. 10, figs. 6-7 (dated July 13). Fly River, Papua.

Family PSEUDOCYCLOTIDAE.

This family is provided to accommodate a series of New Guinea operculates, which according to anatomists are neither Cyclotids nor Cyclophorids. The true *Pseudocyclotus* has a shell agreeing in detail with that of *Leptopoma*, but with a different radula and operculum. From criticism of the latter, Thiele classed it next to *Omphalotropis*, a quaint solution.

Genus PSEUDOCYCLOTUS Thiele, 1894.

1894. *Pseudocyclotus* Thiele, Nachr. deutsch. Malak. Gesell., Year 26, p. 23, January-February No. Orthotype, *Cyclostoma novaehiberniae* Quoy & Gaimard.

1885. *Adelostoma* Smith, Proc. Zool. Soc. (Lond.), 1885, p. 596, October 1, ex Tapparone-Canefri MS. Logotype, here selected, *Cyclotus tristis* Tapparone-Canefri. Not *Adelostoma* Duponchel, Mém. Soc. Linn. Paris, Vol. 6, p. 342, 1827 (Sherborn).

1886. *Adelomorpha* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xxiv., p. 165 (dated November 23). Logotype, here selected, *Cyclotus tristis* T.-C. Not *Adelomorpha* Snellen. Tijdsch. Ent., Vol. 28, p. 31, 1885 (Neave).

The shell is very like that of *Leptopoma* in every conchological feature but is smaller and with more pronounced striae. The operculum, instead of being horny is calcareous, with the outer surface concave. The radula, according to Martens and Thiele, is of the Cyclostomatid form, rather than of the Cyclophorid. Obviously this is purely convergential. Hedley was inclined to lump all the species under the name *levis*, but the geographical forms should be kept separate.

PSEUDOCYCLOTUS TRISTIS Tapparone-Canefri, 1883.

1883. *Cyclotus tristis* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 255, pl. 10, figs. 4-5 (dated July 13). Fly River, Papua.

This is one of the smallest of the genus, measuring 5 mm. by 4 mm., narrower, and with more marked sculpture than the type.

PSEUDOCYCLOTUS PARVUS Hedley, 1891.

1891. *Leptopoma parvum* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 111, pl. xii., bis., fig. 43, September 9. Milne Bay, Papua.

This is larger than the preceding, measuring 6 mm. by 5 mm., while from the Purari Valley comes another, larger still, measuring 7 mm. by 5.5 mm., with the umbilicus wider and fainter sculpture, and may be called *P. exiguus* sp. nov.

A specimen from Mount Maneao, N.E. Papua, is very unlike *P. laeta* Möllendorff, from Astrolabe Bay, North Coast, being very small and tightly coiled, spire narrow, umbilicus almost hidden, measuring 5 mm. by 4.5 mm., and may be called *P. debilior* sp. nov.

Genus DOMINAMARIA *nov.*

Type, *Otopoma macgregoriae* Hedley.

The shell recalls that of *Leptopoma* in general features, but is covered with a fine pilose periostracum, spirally arranged in fine lines, recalling the sculpture of *Leptopoma*. The operculum internally is horny as in *Leptopoma*, but this is overlain by three layers of calcareous matter, the two inner vacuolar, the outer solid, the outer surface very concave, showing four whorls separated by deep channels, the inner pit depressed.

DOMINAMARIA MACGREGORIAE Hedley, 1894.

1894. *Otopoma macgregoriae* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. ix., p. 385, pls. xxiv. and xxv., figs. 5, 7, 20, December 10. Purari Valley, Papua.

DOMINAMARIA ADDITA *sp. nov.*

Shells with similar opercular characters to the preceding are smaller, more elevated, with the pilose periostracum overridden by a further longitudinal series of bristles, the shell being subkeeled, the keel bearing longer bristles. These come from the Fly River, and the largest measures 9 mm. in height by 7 mm. in breadth, a smaller one with operculum measuring 7 mm. in height by 5 mm. in breadth.

DOMINAMARIA HORRIDA Hedley, 1891.

1891. *Cyclotus horridus* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 108, pl. xii., bis., fig. 40, September 9. Milne Bay, Papua.

This has a similar operculum to the lastnamed, and has also the same style of sculpture and bristly ornament, but the shell is more uncoiled and flattened, measuring 9 mm. broad by 7 mm. high.

DOMINAMARIA FERELEGANS *sp. nov.*

1896. *Cyclotus horridus* Smith, Journ. Malac., Vol. v., p. 20, pl. ii., figs. 16-18, June 25. North of Orangerie Bay, Papua (Anthony).

This species recalls the preceding, but is much larger, measuring 16-17 mm. in diameter, the bristles coarser and forming a median keel.

DOMINAMARIA BELFORDI Hedley, 1891.

1891. *Cyclotus belfordi* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 109, pl. xii., bis., fig. 42, September 9. Mita, Milne Bay, Papua.

DOMINAMARIA KOWALDI Hedley, 1891.

1891. *Cyclotus kowaldi* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 109, pl. xii., bis., fig. 41, September 9. Sudest Is., Louisiades.

These species may not be congeneric when the opercula are received, while none of them posssss the basal spur of the type, so that subgenera may be constituted later for the two latter, while *Memonella* subg. n. is here introduced for *Dominamaria addita*, and *Atrocyclus* subgen. n. for *Cyclotus horridus* Hedley.

Family CYCLOTROPIDAE.

Thiele has placed *Cyclotropis* as a section of the European genus Paludinella, a member of the family Assimineidae, an absurd procedure. The genus was introduced by Tapparone-Canefri for a shell measuring 12 mm. in height by 7½ mm. in breadth, of "Omphalotropid" appearance, but with the spire sharply acute, body whorl very large, smooth, finely longitudinally striate, and a narrow umbilicus with marginal keel.

CYCLOTROPIS PAPUENSIS Tapparone-Canefri, 1883.

1883. *Cyclotropis papuensis* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 279, pl. 10, figs. 22-23 (dated July 14). Fly River, Papua.

Shells congeneric are at hand from the north-east coast, British New Guinea, that is Collingwood Bay, and these measure 10 mm. in height by 8 mm. broad, thus shorter and broader, and these may be called *C. rigens* sp. nov.

Family REALIIDAE.

This family name based on *Realia* Gray, not *Realia* of recent writers, must be used for the molluscs classed hitherto as *Omphalotropids*. *Realia* was first introduced by Gray in 1840 as a *nomen nudum*, and this nude usage continued in 1844 and 1847, but in the Proc. Zool. Soc. (Lond.), 1849, 167, he introduced it with a new species *egea* from New Zealand. This paper did not appear until June, 1850, and meanwhile Gray had published the name in the Figs. Mollusc. Anim., Vol. iv., p. 20 (which came out before June, 1850), in connection with two species only, *rubens* Quoy, and *erosa* Quoy. He gives the number allotted to the P.Z.S., 1847, p. 182, reference. Hence *Realia* must date from this entrance, and the type is selected as *rubens* Quoy. In a little book entitled Nomen. Moll. Anim. Brit. Museum, Pt. I., Cyclophoridae (with preface dated March, 1850, and issued June 12, according to Sherborn) *Realia* is included with nine specific names, the last one being *R. egea* with the incomplete reference of "P.Z.S., 1849". Pfeiffer was then engaged to prepare a Cat. Phaneropneum. Brit. Mus., and this was issued in 1852-53, the pref. date being September 16, 1852, and date of publication (Sherborn) February 12, 1853. In that place *Liarea* (p. 217) is introduced as a new name for *Realia egea*, and *Realia* is used for the other species, *rubens* being given as basis of Gray's earlier usage. This should be accepted, as Pfeiffer, at the same time, sank his own *Omphalotropis* as a synonym. A couple of years later Pfeiffer revoked, and his later usage has been incorrectly followed. *Omphalotropis* was also somewhat confusedly introduced in a list in the Zeitschr. für Malak., Year 8, No. 11, p. 176. Nov. with six species, the first *hieroglyphica* Fer., being here named as type. The list was continued the succeeding month, and one of the later named species has been often cited as type.

Genus STENOTROPIS Möllendorff, 1897.

1897. *Stenotropis* Möllendorff, Nachr. Malak. Gesell., Vol. xxix., p. 167, December 20. Logotype (here selected) *Omphatotropis* (sic) *ducalis* Möllend., ex Boettger MS. (Duke of York Is.).

STENOTROPIS BRAZIERI Hedley, 1891.

1891. *Omphalotropis brazieri* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 101, pl. xii., fig. 33, September 9. Milne Bay, Papua.

STENOTROPIS PROTRACTA Hedley, 1891.

1891. *Omphalotropis protracta* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 101, pl. xii., fig. 34, September 9. Mission Hill, Upper St. Joseph (Angabunga) River, Hall Sound, Papua.

STENOTROPIS PAPUENSIS Smith, 1896.

1896. *Omphalotropis papuensis* Smith, Journ. Malac., Vol. v., p. 19, pl. ii., fig. 19, June 25. North of Orangerie Bay, Papua (Anthony).

Note: These three species may not be congeneric or even accurately referable to the above genus, but this is the nearest named group available.

Family PUPINELLIDAE.

This family has developed extensively in the Louisiade Group, reaching a very large size. The true *Pupinella* is a Philippine Island form, the name being introduced in a British Museum catalogue, entitled "Nomen. Moll. Brit. Mus." This book has no author's name mentioned, the preface being signed by J. E. Gray, but now the work is assigned to Baird, upon whose authority I know not. It may be recorded that all contemporaneous writers, such as Herrmannsen, H. & A. Adams, Pfeiffer, etc., credit the authorship of *Pupinella* to Gray. None of the many Papuan species agrees with the Philippine type, so that names have to be introduced for the various groups now known. The species vary from comparatively small to very large, i.e., over 30 mm. in height. The adults are pupiform and solid, with a circular mouth, the last whorl large and practically non-umbilicate. The immature, however, is a thin conical helicoid with a very large perspective umbilicus and a rather square mouth. It still is very unlike any Cyclostomatid, Cyclotid or Cyclophorid form of shell with which they are associated by some workers such as Thiele.

Genus SCAEOPUPINA *nov.*

Type, *Pupina forbesi* Pfeiffer.

Shell large, pupiform, a little excentric, umbilicate, two canals present. The umbilicus varies from open to a chink only. The posterior canal faint and the anterior lateral canal merely notches the columellar margin, varying from a complete notch to a slight indentation, the last whorl strongly pitted.

SCAEOPUPINA FORBESI Pfeiffer, 1852.

1852. *Pupina forbesi* Pfeiffer, Zeitschr. für Malak., 1851, p. 150, refers to Ic., figs. 19-20, probably not yet published: Syst. Conch. Cab. Band I., Abth. 19, p. 238, pl. 31, figs. 19-20, August, 1852, for *P. grandis* Forbes, "P.Z.S., 1851", nec Gray.

1851. *Pupina grandis* Forbes, Voy. Rattlesnake, Vol. ii., p. 380, pl. 2, figs. 10a-d, "1852" = December, 1851. South East Is., Louisiades. Not *Pupina grandis* Gray, A.M.N.H., Vol. vi., p. 77, September, 1840.

SCAEOPUPINA ANGASI Brazier, 1875.

1875. *Pupina angasi* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 5, April 27, "New Guinea—Capt. Hovell" = Rossel Is., Louisiades.

1889. *Pupinella louisiadensis* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 204, pl. 13, figs. 3-4, September. Rossel Is.

SCAEOPUPINA SMITHII Smith, 1891.

1891. *Pupinella smithii* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. vii., p. 136, January. ex Brazier MS. New name for

1875. *Pupinopsis angasi* H. Adams, Proc. Zool. Soc. (Lond.), 1875, p. 389, pl. 45, figs. 2, 2a, October 1. Louisiade Archipelago. Not *P. angasi* Brazier, April 1875, *supra.*

[1873. *Pupina grandis* var. *minor* Cox, Proc. Zool. Soc. (Lond.), 1873, p. 567, November. Louisiades. Indeterminate.]

SCAEOPUPINA ROSSELIANA Smith, 1889.

1889. *Pupinella rosseliana* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 205, pl. 13, figs. 5, 6, 6a, September. Rossel Is.

Genus DIDOMASTA *nov.*

Type, *Pupinella macgregori* Smith.

Very large solid excentric pupiform shells, imperforate in adult, coarsely

pitted, mouth round, anterior canal developed into a curl, aperture opening downwards, posterior canal obsolete.

DIDOMASTA MACGREGORI Smith, 1889.

1889. *Pupinella macgregori* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 205, pl. 13, figs. 1-2, September. Rossel Is.

Genus FANTEMA *nov.*

Type, *Pupinella minor* Smith.

Small for the huge Pupinellids of the Louisiades, this is more regular, the spire more pointed, pitting absent, longitudinal striation present on last whorl, imperforate, anterior canal horizontal produced into a tube with curl opening upwards, posterior canal narrow vertical.

FANTEMA MINOR Smith, 1889.

1889. *Pupinella minor* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 205, pl. 13, figs. 7-8, September. Rossel Is.

Genus BIAMORA *nov.*

Type, *Pupina moulinsiana* Fischer & Bernardi.

Similar in size and form to the preceding, but with very pronounced longitudinal plication, umbilical chink present, anterior canal not produced, posterior vertical, and operculum with strongly fringed outer surface.

BIAMORA MOULINSIANA Fischer & Bernardi, 1857.

1857. *Pupina moulinsiana* Fischer & Bernardi, Jour. de Conch., Vol. v., p. 299, pl. 9, figs. 6-7, January. "New Caledonia, error = Woodlark Is.

1857. *Pupina leucostoma* Montrouzier, Essai Fauna Woodlark Is., p. 136 (cites) Ann. Soc. Imp. Agric. Hist. Nat. et Arts., Lyon, 1856. Woodlark Is.

1871. *Pupina intermedia* Brazier, Proc. Zool. Soc. (Lond.), 1871, p. 586, August 16, ex Angas MS. in synonymy.

Genus BRAZIERA Smith, 1887.

1887. *Braziera* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 424, pl. 15, fig. 15, June 1, in synonymy ex *Braziera typica* Brazier, Proc. Linn. Soc. N.S.W., Vol. vii., p. 35, 1883, *nomen nudum.* Haplotype, *Megalomastoma brazierae* Smith.

BRAZIERA BRAZIERAE Smith, 1887.

1887. *Megalomastoma brazierae* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 424, pl. 15, fig. 15, June. Fergusson Is.

1887. *Braziera typica* id., ib., ex Brazier, as above, *nom. nud.*

BRAZIERA AIGNANENSIS Hedley, 1891.

(Plate iii., fig. 22.)

1891. *Pupinella brazierae* var. *aignanensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 105, September 9. St. Aignan = Misima, Louisiades.

Genus HELAPOSA *nov.*

Type, *Pupinella crossei* Brazier.

Shell small, regular, spire acuminate, striate, perforate, umbilical area keeled, mouth circular with lip reflected all round, anterior canal horizontal, posterior obsolete.

HELAPOSA CROSSEI Brazier, 1876.

1876. *Pupinella crossei* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 111, July. Yule Is. Figd. Tapparone-Canefri, loc. cit., p. 267, pl. x., figs. 20-21, 1883.

Genus ALLISMA *nov.*

Type, *Pupinella tapparonei* Hedley.

Shell small, regular, spire sharply acuminate, imperforate, finely striate, posterior canal deep, vertical, anterior slit well marked, heavy body glaze, outer lip much expanded, operculum with obsolete fringing externally.

ALLISMA TAPPARONEI Hedley, 1891.

1891. *Pupinella tapparonei* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 106, pl. vii., fig. 36, September 9, ex Brazier MS. Fly River, Papua.

Genus BELLARDIELLA Tapparone-Canefri, 1883.

1883. *Bellardiella* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 265 (dated July 14). Haplotype, *B. martensiana* T.-C.

BELLARDIELLA MINOR Hedley, 1891.

1891. *Bellardiella minor* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 102, pl. xii., fig. 35, September 9. Mission Hill, Hall Sound, Papua.

The typical *Bellardiella* is a small Pupinellid with a somewhat acuminate spire, deeply umbilicate, and the circular mouth complete, without any slits, but the anterior slit developed into a tube behind. The type was from Western New Guinea, and the Papuan shell is smaller, imperforate, and in the juvenile stage shows the slit in the lip seen in other groups, but placed lower down, and opening basally, with no signs of posterior canal. The more pointed spire, more swollen body whorl, more circular aperture, and non-umbilicate indicates a subgeneric distinction, which can be named *Litabella* nov.

Family PUPINIDAE.

The small glassy Pupinids seem well distinguished from the larger dull Pupinellids in every feature.

Genus PUPINA Vignard, 1829.

1829. *Pupina* Vignard, Ann. Sci. Nat. Paris, Vol. xviii., p. 439, pl. 11c, December. Haplotype, *P. keradrini* (*keraudrenii* correctly on plate), New Guinea.

PUPINA GIBBA Hedley, 1891.

1891. *Pupina gibba* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 107, pl. xii., fig. 38, September 9. Upper St. Joseph River, Hall Sound, Papua.

PUPINA OVALIS Hedley, 1891.

1891. *Pupina ovalis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 106, pl. xii., fig. 37, September 9. Mita, Milne Bay, Papua.

A large series from Round Is., Louisiades, shows a larger shell, measuring 10 x 6.5 mm., less swollen medially, with the anterior aperture less pronounced, which may be called *P. teres* sp. nov.

PUPINA TORTIROSTRIS Sowerby, 1917.

1917. *Pupinella tortirostris* Sowerby, Proc. Mal. Soc. (Lond.), Vol. xii., p. 320, November 10. Sudest Is., Louisiade Archipelago.

Family DIPLOMMATINIDAE.

Only one species has so far been recorded from Papua, but probably many species will later be found as these minutiae need looking for.

Genus EUADNITA *nov.*

Type, *Diplommatina symmetrica* Hedley.

This species recalls *Gastroptychia* and *Sinica*, but is separated by its regular form, its somewhat acuminate spire, its bold sculpture and its

dextral aperture with columellar tubercle and duplicate expansion of outer lip.

EUADNITA SYMMETRICA Hedley, 1891.

1891. *Diplommatina symmetrica* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 107, pl. xii., fig. 39, September 9. Basilaki (= Moresby) Is.

Subclass PULMONATA.

The development of large "Zonitids" and the lack of "Helicids" are notable features in contrast to the Australian fauna, and, though there may be many small species yet to be discovered, these differences will not be much altered. Many families will later be utilised for their reception, while very many genera will be needed, the genera in use showing very incongruous associations, obviously of heterogeneous origins.

Order STYLOMMATOPHORA.

Family ELASMATINIDAE.

Genus ELASMIAS Pilsbry, 1910.

1910. *Elasmias* Pilsbry, Nautilus, Vol. xxiii., p. 122, March. Orthotype, *Tornatellina aperta* Pease.

ELASMIAS TERRESTRIS Brazier, 1876.

1876. *Tornatellina terrestris* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 109, July. Yule Is., Papua.

Family GASTROCOPTIDAE.

Genus AUSTRALBINULA Pilsbry, 1916.

1916. *Australbinula* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. xxiv. (pt. 93), p. 11, December 18. Orthotype, *Gastrocopta rossiteri.*

1917. *Australbinula* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. xxiv., pt. 94), pp. 155-166, July 18. Orthotype, *G. hedleyi* Pilsbry = *rossiteri* supra.

AUSTRALBINULA MACRODON Pilsbry, 1917.

1917. *Gastrocopta macdonnelli macrodon* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. xxiv., p. 164, pl. 27, figs. 7, 8, 10, July 18. Mita, Milne Bay, Papua.

Hedley had recorded this as *Pupa pedicula,* but Pilsbry has separated it as above, and the large teeth suggest its subgeneric distinction with the name *Papualbinula.*

Family SUBULINIDAE.

Hedley recorded from Milne Bay, the egregious *Stenogyra subula,* which was regarded as *Opeas gracile* by Pilsbry, but there is now grave doubt of the conclusions there reached. Preston has named specimens from Milne Bay as distinct, and these may be later discussed.

Family SUCCINEIDAE.

Genus PAPUSUCCINEA *nov.*

Type, *Succinea simplex* Hedley, not Pfeiffer = *strubelli* Strubell.

Hedley described and figured the Papuan *"Succinea"* under the name *S. simplex* Pfeiffer (a New Hebridean species), and later gave figures of the jaw and radula, which separate the species from the Australian and Pacific Island forms.

PAPUSUCCINEA STRUBELLI Strubell, 1895.

1895. *Succinea strubelli* Strubell, Nachr. d. Malak. Gesell., Year 27, p. 152, ex Kobelt MS., September-October, 1895. Cloudy Mts., Papua.

1895. *Succinea papuana* Strubell, id. ib. Lorne Range, north of Orangerie Bay, Papua.

1891. *Succinea simplex* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 100, pl. xii., fig. 32, September 9. (Milne Bay, Papua) id. ib., p. 691, pl. xlii., fig. 34 (jaw), and fig. 37 (radula).

Family PARTULIDAE.

Typical members of this Polynesian family have been found on Woodlark Island and the eastern tip of Papua, and aberrant members further inland.

Genus MELANESICA Pilsbry, 1909.

1909. *Melanesica* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. xx., p. 166, September 29. Orthotype, *Partula turneri* Pfeiffer.

MELANESICA SIMILARIS Hartman, 1886.

1886. *Partula similaris* Hartman, Proc. Acad. Nat. Sci. Philad., 1886, p. 30, pl. ii., fig. 1. Woodlark Is.

1886. *Partula woodlarkiana* id. ib., p. 33, pl. ii., fig. 8. Same locality.

Type of *similaris* refigured by Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. xx., p. 302, pl. 37, fig. 13, type of *woodlarkiana*, fig. 16, and specimens from Trobriand Is., figs. 14-15. Clench records the species from mainland, East Cape, Papua, while a *Partula* occurs on the Laughlan Group.

MELANESICA OCCIDENTALIS Hedley, 1891.

1891. *Partula occidentalis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 98, pl. xii., fig. 31, September 9. Samarai Is.

Genus SCILISTYLUS *nov.*

Type, *Placostylus remotus* Hedley.

Although Hedley recorded this as a *Placostylus* it is nothing like the type of that genus, and has most of the characters of the Partulidae, though it is somewhat aberrant. Its large size, sculpture, umbilical chink, thickened lip, also separate it even as Hedley, at the time suggested, the lengthened somewhat regular spire being characteristic.

SCILISTYLUS REMOTUS Hedley, 1898.

1898. *Placostylus remotus* Hedley, Proc. Linn. Soc. N.S.W., vol. xxiii., p. 97, fig. in text, June 23. Mambare Goldfield, Northern-border, Papua.

Genus AMIMOPINA Iredale, 1933.

1933. *Amimopina* Iredale, Rec. Austr. Mus., Vol. xix., p. 42, August 2. Orthotype, *Bulimus beddomei* Brazier.

AMIMOPINA MACLEAYI Brazier, 1876.

1876. *Bulimus macleayi* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 108, July. Yule Is., Papua.

1894. *Partula macleayi* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. ix., p. 387, pl. xxvi., figs. 22-23, December 10. Rigo, Papua (English).

At the latter citation, Hedley figured the jaw and radula (160 x 40.6.1.6.40), and on this data assigned this peculiar form to this location.

Family PARALAOMIDAE.

Genus PAPULAOMA *nov.*

Type, *Flammulina abdita* Hedley.

This alpine species ascribed to *Flammulina* seems to range better in this family, its minute size, form and sculpture recalling that of members, the protoconch being spirally lirate, separating it from the east Australian true *Paralaoma*.

PAPULAOMA ABDITA Hedley, 1897.

1897. *Flammulina abdita* Hedley, Rec. Austr. Mus., Vol. iii., p. 47, pl. xi., figs. 10-12, August 5. Mount Scratchley, 12,200 ft., Papua.

Family CHAROPIDAE.

Genus MISSIOCLIVUS *nov.*

Type, *Charopa texta* Hedley.

Not much like typical *Charopa*, and its turbinate form and narrow umbilicus, its finely radiate protoconch, rather coarse sculpture, small mouth, size, combine to distinguish it from any Australian named group.

MISSIOCLIVUS TEXTUS Hedley, 1891.

1891. *Charopa texta* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 79, pl. x., fig. 12, September 9. Mission Hill, Upper St. Joseph River, Hall Sound, Papua.

Family MICROCYSTIDAE.

This family name seems to be in doubt, but Burrington Baker's use of Helicarionidae, with numerous subfamilies, is a worse expedient.

Genus EXPOCYSTIS Iredale, 1937.

1937. *Expocystis* Iredale, Austr. Zool., Vol. ix., p. 4, November 12. Orthotype, *Helix rustica* Pfeiffer.

EXPOCYSTIS SAPPHO Brazier, 1876.

1876. *Helix* (*Thalassia*) *sappho* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 100, July. Yule Is. Specimens from Maiva, Mission Hill, figured by Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 77, pl. ix., fig. 7, September 9; and anatomy, id. ib., p. 686, pl. xxxviii., fig. 7, and pl. xxxviii., fig. 4 (radula, 96 x 36.10.1.10.36).

EXPOCYSTIS BRUIJNII Tapparone-Canefri, 1883.

1883. *Nanina bruijnii* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 206, pl. 5, figs. 13, 14, 15. Fly and Katow Rivers, Papua.

EXPOCYSTIS MAILUENSIS Smith, 1896.

1896. *Microcystina sappho* var. *mailuensis* Smith, Journ. Malac., Vol. v., p. 18, June 25. Mailu, north of Orangerie Bay, Papua (Anthony).

EXPOCYSTIS CALCARATA Hedley, 1891.

1891. *Microcystina calcarata* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 76, pl. ix., fig. 8; pl. x., fig. 9, September 9. Mita, Milne Bay, Papua.

Family NITORIDAE.

Genus PRAVONITOR Iredale, 1937.

1937. *Pravonitor* Iredale, Austr. Zool., Vol. ix., p. 3, November 12. Haplotype, *Nitor kreffti* Cox.

PRAVONITOR ANNULUS Brazier, 1876.

1876. *Helix* (*Thalassia*) *annulus* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 100, July. Marrahata (= Mowatta) Katow River, Papua. Type figured, Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 78, pl. x., fig. 10, 1891.

1883. *Nanina orbiculum* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 204, pl. v., figs. 16, 17, 18; pl. 7 ,fig. 7 (date July 8). Fly and Katow Rivers, Papua.

PRAVONITOR PAPUANUS Smith, 1896.

1896. *Macrochlamys papuana* Smith, Journ. Malac., Vol. v., p. 18, pl. ii., figs. 8-9, June 25. North of Orangerie Bay, Papua (Anthony).

Family HELICARIONIDAE.

The family Helicarionidae is here restricted to the Helicarion-like molluscs, and even so restricted it is almost certainly polyphyletic, and instead of adding unlike groups this family will later be much subdivided. Only two small species have, as yet, been recorded from Papua, but each of these represent a distinct genus.

Genus MISTARION *nov.*

Type, *Helicarion musgravei* Hedley.

Shell small, globose, thin, animal with pointed tail, jaw short and wide, radula of 128 rows with formula 45.18.1.18.45, quite unlike that of the northern Australian *Vercularion*, which has the formula 103.17.1.17.103.

MISTARION MUSGRAVEI Hedley, 1891.

1891. *Helicarion musgravei* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 77, pl. x., fig. 14, September 9. Doura, west of Port Moresby, Papua; id. ib., p. 687, pl. xxxviii., fig. 9 (jaw), and pl. xli., fig. 30 (radula).

Genus ELLARION *nov.*

Type, *Helicarion visi* Hedley.

Shell small, depressed, thin, animal with truncate tail, jaw smooth, radula with formula, 20.12.1.12.20, the great reduction of marginals being quite abnormal.

ELLARION VISI Hedley, 1891.

1891. *Helicarion visi* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 76, pl. x., fig. 13, September 9. Basilaki (= Moresby) Is.

Family DURGELLINIDAE.

Through the confusion brought about by anatomical workers, each amending the other's results, refuge for the small known Papuan shells is taken under the above family name, without prejudice.

Genus DURGELLINA Thiele, 1928.

1928. *Durgellina* Thiele, Zool. Jahrb. Jena. Syst., Vol. 55, p. 135, April 25. Haplotype, *D. vitrina* Thiele (Bismarck Archipelago).

DURGELLINA MAINO Brazier, 1876.

1876. *Helix* (*Conulus*) *maino* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 101, July. Yule Is. Type figured, Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 75, pl. ix., fig. 6, September 9.

DURGELLINA ANTHROPOPHAGORUM Hedley, 1894.

1894. *Sitala anthropophagorum* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. ix., p. 385, pls. xxiv., xxv., xxvi., figs. 1, 3, 21, 24, December 10. Purari Valley, Papua.

Genus SEROSTENA *nov.*

Type, *Helix starkei* Brazier.

Shell small, conical, perforate with coarse radial sculpture. Hedley has described an animal, assigned to this species from Milne Bay, which has the tail keeled, ending in a small horn, while the shell was contrasted with that of the Fijian *subrugosa*, now the type of Burrington Baker's *Dasyconus*.

SEROSTENA STARKEI Brazier, 1876.

1876. *Helix* (*Conulus*) *starkei* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p.

103, July. Yule Is. Type figured by Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 79, pl. ix., fig. 5, September 9, 1891.

Genus CHRONOCERYX *nov.*

Type, *Sitala* ? *sublimis* Hedley.

This minute alpine species is unlike any other Papuan shell, being depressedly turbinate, smooth, with very narrow umbilicus, and may be a relative of *Chronos* Robson (Trans. Zool. Soc. (Lond.), Vol. xx., p. 292, 1910), also from the highlands of New Guinea.

CHRONOCERYX SUBLIMIS Hedley, 1897.

1897. *Sitala* ? *sublimis* Hedley, Rec. Austr. Mus., Vol. iv., p. 47, pl. xi., figs. 4, 5, 6, August 5. Mount Scratchley, 12,200 ft., Papua.

Genus PARATROCHUS Pilsbry, 1893.

1893. *Paratrochus* Pilsbry, Man. Conch., Tryon, Ser.* 2, Vol. viii., p. 295, July 1. Haplotype, *Helix dalbertisi* Brazier.

At the place given, Pilsbry introduced this group as a section of *Endodonta,* referring to a figure in Vol. ix., pl. iii., figs. 20-21, but when that volume was issued, November 16, 1893, the figure, a copy of Hedley's, appeared on pl. vi., figs. 55-56. Möllendorff stated that this group should be referred to *Aulacospira,* while Fulton referred a second species to *Ganesella,* under the subgenus *Coliolus,* a very different looking shell.

PARATROCHUS DALBERTISI Brazier, 1876.

1876. *Helix* (*Ochthephila*) *dalbertisi* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 104, July. Yule Is., Papua. Type figured by Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 79, pl. x., fig. 11, September 9, 1891.

PARATROCHUS WEISKEI Fulton, 1902.

1902. *Ganesella* (*Coliolus*) *weiskei* Fulton, Ann. Mag. Nat. Hist., Ser. 7, Vol. ix., p. 184, March. Kemp Welsh River, Papua (E. Weiske).

Note: Gude (Proc. Mal. Soc. (Lond.), Vol. vi., p. 116, June, 1904), recorded *Ganesella euconus* Möllendorff, from "Dinawa, British Central New Guinea, 3,600 ft.", from a single dead specimen. Möllendorff described *Satsuma euconus* (Proc. Mal. Soc. (Lond.), Vol. i., p. 235, pl. xv., fig. 2, March, 1895), a shell measuring 16.5 mm. by 16 mm., from Astrolabe Bay, in the north of New Guinea.

Family XESTIDAE.

The huge aggregation of molluscs known as "Zonitids" must be divided into many groups, and these are here regarded as families. Burrington Baker has published a brilliant and exhaustive account of Zonitid shells from the Pacific Islands (Bernice P. Bishop Museum, Bulletins 158 (1938), 165 (1940) and 166 (1941)), but this has proved of little assistance in connection with the problems presented by the Papuan forms. Based on anatomical work, the Zonitids have been treated in an iconoclastic (his own word) manner, and his results bring back to mind the measured opinion of a master (G. B. Howes, Proc. Malac. Soc. (Lond.), Vol. ii., p. 74, July, 1896), who wrote: "In other words, so-called 'systematics', properly pursued, is but a branch of morphology, and the so-called 'systematist' is a morphologist; and your anatomist, in deriding the species-man, is discounting his own occupation. . . . I am bound to confess that the systematology of the anatomist offends me vastly more than the anatomy of the taxonomist". The only method of reaching stability in connection with these molluscs is

by collaboration between an experienced conchologist such as the "guessing Gude" with an able anatomist such as Baker, the latter attempting to confirm the former's conclusions, and when that proves impossible the former to review his results in the face of the facts provided by the anatomist. By these means an approximation to reality would be practically achieved.

Genus XESTA Albers, 1850.

1850. *Xesta* Albers, Die Heliceen, 1st ed., p. 58. Logotype (Martens), Die Heliceen (Albers), 2nd ed., Systematic List, p. xii., 1861), *Helix citrina* L.

Note: The claims of *Naninia* Sowerby, 1839, error for *Nanina* Gray, are not worthy of notice.

XESTA OLDHAMIANA *sp. nov.*

(Plate iii., fig. 1.)

The many species accumulated under the name *citrina* are usually easily differentiated. Thus a series sent by Mr. R. Oldham from behind Port Moresby are all alike in coloration, size and form, differing from the true *citrina* from the Moluccas. They are uniform lemon with the first two apical whorls red brown, and are smaller and more elevated than *citrina* with the whorls more rounded. The type measures 37 mm. broad by 25 mm. high.

XESTA INTERJECTA *sp. nov.*

(Plate iii., fig. 2.)

A series from the Fly River and the Purari Valley may be tentatively associated, as they are less elevated than the preceding, and, though the apical whorls are still red-brown, the succeeding ones are pale creamy white with a green band below the suture and a broader green band around the base, sometimes with a purple supraperipheral line. The juveniles show the same coloration. The type measures 35 mm. by 21 mm. from the Purari Valley.

XESTA DINAWA *sp. nov.*

(Plate iii., fig. 7.)

Recorded by Gude (Proc. Mal. Soc. (Lond.), Vol. vi., p. 115, June 23, 1904), as *Hemiplecta campylonota*, a Dorey species, though Gude noted differences. The shells themselves are very distinct, the convex spire being peculiar, the base being equally convex, the mouth thus rather small, being about as high as broad, a rounded keel present peripherally, the sculpture above being of very fine radial striae, apical whorls smooth with well marked radial curved ripples suturad, horn colour, with a peripheral darker colour band. Size: 36 mm. broad by 22 mm. high, from Dinawa, Central Papua.

XESTA COMPLICATA *sp. nov.*

(Plate iii., fig. 9.)

Mr. A. C. English collected a number of shells at Cloudy Bay, Papua, and amongst them are two species belonging to this series. One is a large flattened *Xesta* recalling the true *X. citrina* in shape and appearance, the other more conical related to the preceding species. Shell large, depressedly turbinate, spire little elevated, periphery obsoletely keeled, base well rounded, mouth large, outer lip not descending, broader than high, lip thin, umbilicus very narrow, the columellar reflection slight, not obscuring the umbilicus. The sculpture consists of very fine radial striae above, with a very minute transverse striation below. Coloration pale fawn above, almost white below,

a narrow brown band encircling the whorl below the periphery. Breadth, 43 mm.; height, 24 mm.

XESTA CORNECEREA *sp. nov.*

(Plate iii., fig. 4.)

Shell large, very thin, depressedly conical, spire whorls a little convex, last whorl rounded, not descending, mouth longer than broad, base comparatively less rounded than in preceding, mouth shorter and deeper, umbilicus still narrower and obscured by slight columellar reflection. Sculpture of fine radial striae above and a still finer spiral striation below. Coloration pale horny with an indistinct subperipheral darker band. Breadth, 42 mm.; height, 27 mm. Cloudy Bay, Papua (A. C. English).

With this was another specimen which seems to be a large representative of *X. dinawa,* agreeing in all essential features, but with the upper sculpture more pronounced, the lower surface with minute spirals, coloration paler, measuring 39 mm. broad and 25 mm. high. This may be called *X. dinawa nubilisinus* subsp. nov. (Plate iii., fig. 5), and made the basis of a new subgenus, *Corneoxesta.*

XESTA FRAUDULENTA Smith, 1887.

1887. *Nanina fraudulenta* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 417, June. Foot of Astrolabe Mts., Papua.

This was described as like *hunsteini,* measuring 42 mm. in breadth by 24 mm. high, but without the spiral striae of that species, and has not been seen since.

Genus AMENIXESTA *nov.*

Type, *Nanina hunsteini* Smith.

This *Xesta*-like species has a smaller spire, more globose form than *Xesta,* but is finely sculptured throughout. The anatomy of the snails has been shown to differ, while the radular formula is 160 x 90.20.1.20.90, and that of *citrina* is given as 125.24.1.24.125.

AMENIXESTA HUNSTEINI Smith, 1887.

1887. *Nanina hunsteini* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 416, pl. 15, fig. 6, June. Foot of Astrolabe Mts., and Owen Stanley Range, presented by Brazier (coll. Goldie).

From Fife Bay, south-east coast, specimens are smaller, spire a little more elevated, mouth more globose, as high as long, and sculpture finer, the type measuring 30 x 25 x 21 mm., against *hunsteini,* 40 x 33 x 25 mm. This may be called *A. fifensis* sp. nov. Hedley collected shells at Milne Bay, north-east point, and regarded them as typical, describing their anatomy (Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 685, pl. xxxviii., fig. 1, and pl. xxxix., fig. 11, and pl. xlii., fig. 39, June 10, 1892). These show finer sculpture and are less swollen than typical ones, whorls still very rounded, mouth longer than high, measuring 35 x 29 x 20 mm., and may be called *A. mita* sp. nov. (Plate iii., fig. 10; *fifensis,* Plate iii., fig. 3).

Genus ZAGMENA *nov.*

Type, *Helix inclinata* Pfeiffer.

Shell lentilshaped, whorls flattened, sutures lightly impressed, strongly keeled, basally swollen, aperture not descending, mouth elongate, lip thin, perforate, perforation very small, coloration brown-red, sculpture fine thread-like radials, apex shows strong curved radials suturad.

ZAGMENA INCLINATA Pfeiffer, 1864.

1864. *Helix inclinata* Pfeiffer, Proc. Zool. Soc. (Lond.), 1863, p. 526, April 25, 1864. Louisiade Group = Misima, fide Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 200, pl. 13, fig. 16, September 1889, type figured, 30 x 26½ x 14 mm. Anatomy by Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 686, pl. xl., fig. 20; pl. xxxviii., fig. 3 (radula, 96 x 54.11.1.11.54); and pl. xlii., fig. 38, June 10, 1892.

ZAGMENA DIVISA Forbes, 1851.

1851. *Helix divisa* Forbes, Voy. Rattlesnake, Vol. ii., p. 376, pl. ii., figs. 5a-b., 23 x 20 x 11 mm., "1852" = December, 1851. South East Island, Louisiades.

ZAGMENA ROSSELIANA Smith, 1889.

1889. *Nanina rosseliana* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 200, pl. 13, fig. 15 (40 x 36 x 21½ mm.), September. Rossel Is.

ZAGMENA WOODLARKENSIS Hedley, 1891.

1891. *Nanina divisa* var. *woodlarkensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 74 (31 x 27 x 17 mm.), September 9. Woodlark Is.

ZAGMENA MINOR Hedley, 1891.

1891. *Nanina divisa* var. *minor* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 74 (22 x 19 x 11 mm.), September 9. Mita, Milne Bay, Papua.

ZAGMENA INFELIX Smith, 1893.

1893. *Nanina infelix* Smith, Conchologist, Vol. ii., p. 109, March 25. Probably British New Guinea. Fig. Smith, Journ. Malac., Vol. v., p. 17, pl. ii., figs. 6-7 (type, 24 x 21 x 12 mm.), June 25, 1896 (from Orangerie Bay).

1895. *Nanina* (*Hemiplecta*) *strubelli* Strubell, Nachr. d. Malak. Gesell., 27th Year, p. 151 (September-October) (24 x 21 x 12 mm.), ex Kobelt MS. Cloudy Mts. (= Bay), New Guinea. Figured, Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p. 828, pl. 224, figs. 9, 10, 1897.

ZAGMENA OUGARRANA Smith, 1905.

1905. *Hemiplecta ougarrana* Smith, Ann. Mag. Nat. Hist., Ser. 7, Vol. xvi., p. 195 (22.5 x 20 x 10.5 mm.), August. Owgarra, An(g)abunga River, Owen Stanley Range, 8,000 ft., Papua.

ZAGMENA PRATTI Gude, 1904.

1904. *Euplecta pratti* Gude, Proc. Mal. Soc. (Lond.), Vol. vi., p. 114, figs. in text (18 x 16 x 8.5 mm.), June 23. Dinawa, 3,600 ft., inland from Hall Sound, Papua (E. A. Pratt).

ZAGMENA CAIRNI Smith, 1887.

1887. *Nanina cairni* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 417, pl. 15, fig. 5 (36 x 31 x 20 mm.), June. Foot of Astrolabe Mts., Papua.

ZAGMENA EGBERTAE Martens, 1883.

1883. *Nanina egbertae* Martens, Jahrb. d. Malak. Gesell., Vol. x., p. 81 (32 x 27½ x 18 mm.), January = February. Taburi (Astrolabe Mts.), South East New Guinea (O. Finsch).

ZAGMENA JANSONI Smith, 1905.

(Plate iii., fig. 6.)

1905. *Hemiplecta jansoni* Smith, Ann. Mag. Nat. Hist., Ser. 7, Vol. xvi., p.

195 (35 x 28 x ?), August. Owgarra, An(g)abunga River, Owen Stanley Range, 8,000 ft., Papua.

ZAGMENA LISSORHAPHE Smith, 1895.

1895. *Nanina lissorhaphe* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 230 (25½ x 22 x 13 mm.), March; figured, id. ib., Vol. xvi., p. 363, pl. 20, figs. 1-2, November. Mt. Maneao, North Coast, Papua.

ZAGMENA AMBLYTROPIS Smith, 1895.

1895. *Nanina amblytropis* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 230 (23 x 20 x 13 mm.), March; figd. id. ib., Vol. xvi., p. 363, pl. 20, figs. 5-6, November. Mt. Maneao, North Coast, Papua.

Family ARIOPHANTIDAE.

The very large Papuan land shells have been referred to *Oxytes, Rhysota, Hemiplecta,* by different workers, so that it becomes necessary to provide a new genus for their reception.

Genus HUNSTEINIA *nov.*

Type, *Oxytes hercules* Hedley.

Shell very large, solid, orbicular, whorls a little convex, malleated above, smooth below, spire little elevated, apical whorls ribbed malleate, conical, whorls sharply keeled peripherally, base somewhat swollen, very narrowly perforate, mouth elongate, lips little thickened. The radular formula of 120 x 90.20.1.20.90 does not agree with that recorded by Semper for typical Rhysotids from the Philippines. Named in memory of Carl Hunstein, a young collector of Papuan land molluscs, who was later killed by a tidal wave in New Britain while engaged in collecting (fide Sharpe, Hist. Coll. Nat. Hist. Brit. Mus., Vol. ii., p. 394, 1906).

HUNSTEINIA HERCULES Hedley, 1891.

1891. *Oxytes hercules* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 70, pl. ix., figs. 1-2 (66 x 55 x 30 mm.), September 9. Fly River, Papua.

HUNSTEINIA FLYENSIS Hedley, 1891.

1891. *Oxytes flyensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 71, pl. ix., figs. 3-4 (60 x 49 x 34 mm.), September 9. Fly River, Papua.

Smith suggested the lumping of Hedley's two species through examination of specimens from unknown localities, with some from north of Orangerie Bay, which almost certainly represent a distinct form from either of the Fly River species. Gude also recorded *Rhysota hercules* var. *flyensis* from Dinawa, which again may prove distinct.

HUNSTEINIA ARMITI Smith, 1895.

1895. *Rhysota armiti* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 231 (45 x 39 x 22 mm.), March; figd. id. ib., Vol. xvi., p. 363, pl. 20, figs. 3-4, November, 1895. Mt. Maneao, North Coast, Papua.

This northern representative is easily differentiated by the peculiar inflation of the base.

HUNSTEINIA BISCULPTILIS Smith, 1905.

1905. *Rhyssota bisculptilis* Smith, Ann. Mag. Nat. Hist., Ser. 7, Vol. xvi., p. 194 (35 x 29 x ?), August. Owgarra, An(g)abunga River, 8,000 ft., Owen Stanley Range, Papua.

Family CALYCIIDAE.

Genus CALYCIA H. Adams.

1865. *Calycia* H. Adams, Proc. Zool. Soc. (Lond.), 1865, p. 412. August 26.

Orthotype, *Bulimus crystallinus* Reeve.

CALYCIA ISSELIANA Tapparone-Canefri, 1883.

1883. *Calycia isseliana* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 101, fig. in text (dated June 25). Katow River, Papua.

Family TROCHOMORPHIDAE.

Once again a Polynesian family just reaches the eastern outskirts of Papua, while the corresponding Moluccan family, Geotrochidae, penetrates into the western portion of Papua. None of the Trochomorphoid generic names used by Burrington Baker are available, so that new names become necessary.

Genus ROSSELIDENA *sp. nov.*

Type, *Trochomorpha nigrans* Smith.

Shell very depressed, Trochomorphoid, spire flatly conical, base flattened, whorls very lightly convex, periphery acutely keeled, base rounded, widely umbilicate, umbilicus about one-third the breadth of the shell, mouth elongate, lip thin, sculpture of obscure growth lines only, apical whorls smoothish, base similarly striate, keel puckered. Radular formula, 118 x 26.23.1.23.26, agreeing exactly with that of *Peleliua*, of the Caroline Group, another case of convergence only.

ROSSELIDENA NIGRANS Smith, 1889.

1889. *Trochomorpha nigrans* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 200, pl. 13, figs. 9-11, September. Rossel Is.

ROSSELIDENA CORNEA Hedley, 1891.

(Plate iii., fig. 12.)

1891. *Trochomorpha nigrans* var. *cornea* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 79, September 9. Sudest Is., Louisiades.

Family GEOTROCHIDAE.

Although agreeing closely conchologically with the Trochomorphids, the Molluscan Geotrochids have been shown to be of different origin. These are represented in the western portion of Papua, but here again new generic names are needed.

Genus GEODISCUS *nov.*

Type, *Helix lomonti* Brazier.

Shell very flattened, thin, spire little elevated, whorls flattened, base little rounded, umbilicus deep, perspective, less than a third the width of base, peripheral keel very acute, slightly puckered above and below, sculpture of very fine radial striation with lower sutural puckering, apical whorls smooth. Anatomical details given by Tapparone-Canefri.

GEODISCUS LOMONTI Brazier, 1876.

1876. *Helix* (*Discus*) *lomonti* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 101, July 1. Yule Is. Figured, Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 91, pl. ii., figs. 5-7 (shell), pl. vi.. fig. 2 (genital system), pl. viii., fig. 3 (jaw), and pl. ix., fig. 4 (radula).

Genus NECVIDENA *nov.*

Type, *Necvidena froggatti* nov.

Shell small, depressedly conical, strongly keeled peripherally, thin, spire elevated, whorls a little rounded, base rounded, deeply umbilicate, umbilicus narrow, mouth subquadrate, outer lip thin, columella thin, vertical, not reflected.

NECVIDENA FROGGATTI *nov. sp.*

(Plate iii., fig. 8.)

This species, collected by W. W. Froggatt at the Fly River, was recorded by Hedley as *Trochomorpha planorbis* Lesson, but Lesson described his species as *Helix* (*Carocolla*) *planorbis* (Voy. Coquille., Zool., Vol. ii., p. 312, pl. 13, fig. 4, 1831), from Dorey, Western New Guinea. It is immaterial to discuss the identity, as Lesson's name is invalid, being preoccupied by Linné.

The Papuan shell measures 13 mm. in breadth by 7 mm. in height, and in addition to the very fine growth radials a fine spiral lining is present, the apical whorls being smooth.

Superfamily HELICOIDEA.

This superfamily is represented in Papua by a strong development of Papuinid and Chloritid forms and very little of the Helicid series, at present only two or three being referred to the lastnamed, and their family name is even doubtful.

Family HADRIDAE.

This family name is used with reservation, as no Australian member of the family is very like the Papuan shells here placed.

Genus MECYNTERA *nov.*

Type, *Thersites septentrionalis* Hedley.

Shell very tall elevated "Helicoid" with lustrous surface, apical whorls smooth, not differentiated, succeeding whorls somewhat flattened, sutures little impressed, sculpture radial growth lines only, outer lip descending a little, thickened and reflected all round, mouth a little oblique, higher than broad, columella vertical, much reflected obscuring narrow umbilicus, strong glaze connecting lips across body whorl.

This is a beautiful development if related to the Australian group, and is quite unlike any north Australian genus such as *Gnarosophia, Hadra,* etc.

MECYNTERA SEPTENTRIONALIS Hedley, 1897.

1897. *Thersites septentrionalis* Hedley, Rec. Austr. Mus., Vol. iii., p. 11, fig. in text, January 7. Musa River, N.E. Coast, Brit. New Guinea.

Genus KENDALLENA *nov.*

Type, *Helix broadbenti* Brazier.

Shell turbinate, spire elevated, whorls rounded, narrowly umbilicate. This bulky shell recalls the Chloritid *Sulcobasis,* and is very dissimilar to the preceding in almost every particular, the sutures more impressed, the whorls rounded, the sculpture stronger, almost ridges, mouth rounded, broader than high, lip strongly reflected all round, columella short, broadly reflected over the narrow open umbilicus. When Hedley gave anatomical details he made no comment save that the jaw with eleven ribs differed from that of the Queensland *Sphaerospira,* which had only 6-8 ribs, and gave the radular formula as 160 x 57.12.1.12.57.

KENDALLENA BROADBENTI Brazier, 1877.

1877. *Helix* (*Hydra*) *broadbenti* Brazier, Proc. Linn. Soc. N.S.W., Vol. ii., p. 25, July. Port Moresby, New Guinea = Laloki River. Figd. Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 188, pl. v., fig. 21, 1883.

The type measured 43 mm. broad and 31 mm. high, and Gude reported that the Dinawa shells were more depressed, but gave measurements as 46

mm. broad by 35 mm. high. Mr. Oldham sent some from somewhere near Port Moresby, and while some agree very closely with the typical shell one beautiful specimen is very elevated, and while it is 48 mm. broad it is no less than 50 mm. in height. It is so very distinct that a new name must be introduced as *Kendallena qualis* sp. nov. (Plate iii., fig. 18).

Note: Smith (Proc. Mal. Soc. (Lond.), Vol. ii., p. 288, November, 1897) recorded *Thersites* (*Hadra*) *forsteriana* Pfeiffer, from Fergusson Island, an obvious error, which he justified with the very naive comment: "Mr. Sowerby, from whom it was obtained for the Museum, has no reason to doubt the correctness of the habitat, since he received the shell with others from a collector who has been travelling in New Guinea and the adjacent islands".

Family PAPUINIDAE.

It may be recalled that only fifty years ago every "Helicoid" snail was classed under the "genus" *Helix*, and Pilsbry (Man. Conch. (Tryon), Ser. 2, Vol. vii., 1891) "defined" the subgenus *Papuina* thus: "No exact diagnosis can be framed for a group in which such diverse forms occur as in *Papuina*. It is still, however, an easy matter to recognize a species as belonging here; for with all its variety, the group is a very natural one". Then to assist in the recognition Pilsbry was compelled to distinguish fourteen groups. A couple of years later Pilsbry allowed *Papuina* generic rank, added another division, and separated one group as a subgenus, the latter being almost immediately shown by Hedley to be referable to another family. I separated the Australian groups, and now having studied the New Guinea and island forms have to distinguish many more.

Genus CANEFRIULA *nov.*

Type, *Helix tomasinelliana* Tapparone-Canefri.

Shell heliciform, solid, whorls well rounded, periphery rounded, mouth open, broader than high, lip reflected, columella broadly reflected, almost concealing the narrow umbilicus, sculpture of radial growth lines sometimes strongly pronounced as in the type. Conchologically the shell is very like that of *Papuina* = *Insularia* = *Eugenia* preocc., but the anatomy has been shown to differ. There may be three or more groups here confused as *taumantias* has flattened base, a more oval lengthened aperture, lip broadly reflected towards a beak-like ending. This may stand as the type of a new subgenus, *Paulodorra*, while *sicula* is somewhat similar in shape but very much smaller, the last whorl sub-keeled and the base more rounded, the aperture less beaked and may be subgenerically named *Medistoma* nov.

CANEFRIULA TOMASINELLIANA Tapparone-Canefri, 1883.

1883. *Helix tomasinelliana* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 148, pl. 4, fig. 1, pl. 5, fig. 1, pl. 7, fig. 3, pl. 8, figs. 6 and 12 (dated July 4). Fly River, Papua.

CANEFRIULA AZONATA Hedley, 1891.

1891. *Geotrochus tomasinellianus* var. *azonatus* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 93, September 9. Douglas River, Papua (Bevan).

1892. *Helix* (*Papuina*) *agnocheilus* Smith, Proc. Zool. Soc. (Lond.), 1891, p. 488, pl. xl., fig. 5, April 1. Douglas River, Papua.

CANEFRIULA RIDIBUNDA Tapparone-Canefri, 1883.

1883. *Helix ridibunda* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix.,

p. 142, pl. 3, figs. 10-11, pl. 6, fig. 5, pl. 8, fig. 17 (dated June 26). Fly River, Papua.

CANEFRIULA SICULA Brazier, 1876.

(Plate iii., fig. 16.)

1876. *Helix* (*Geotrochus*) *siculus* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 106, July. Katow River, Papua.

1883. *Helix meditata* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 144, pl. 3, fig. 15, pl. 6, fig. 6 (dated June 26). Katow River, Papua.

CANEFRIULA GESTROI Tapparone-Canefri, 1883.

1883. *Helix gestroi* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 150, pl. 4, fig. 3, pl. 5, fig. 3, pl. 7, fig. 2, pl. 8, figs. 5 & 14 (dated July 4). Fly River, Papua.

CANEFRIULA BRAZIERAE Brazier, 1876.

1876. *Helix* (*Geotrochus*) *brazierae* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 107, July. Yule Is., Papua. Figured, Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 152, pl. 4, fig. 2, pl. 5, fig. 2, pl 7, fig. 1, pl. 8, figs. 7-13, 1883.

CANEFRIULA CYNTHIA Fulton, 1902.

(Plate iii., fig. 11.)

1902. *Papuina cynthia* Fulton, Ann. Mag. Nat. Hist., Ser. 7, Vol. ix., p. 183, March. British New Guinea (ex C. E. Beddome as *brazierae*).

CANEFRIULA HIXSONI Brazier, 1877.

1877. *Helix hixsoni* Brazier, Proc. Linn. Soc. N.S.W., Vol. ii., p. 120, July. Hall Sound, Papua. Figured, Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 187, pl. v., fig. 22, 1883; Tryon, Man. Conch., Ser. 2, Vol. vi., p. 177, pl. 25, fig. 91, 1890.

CANEFRIULA LACTEOLOTA Smith, 1887.

1887. *Helix* (*Geotrochus*) *lacteolota* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 420, pl. 15, fig. 9, June. Foot of Owen Stanley Mountains, Papua.

Specimens received from London labelled "*lacteolota* British New Guinea" vary from tall very narrow specimens to tall comparatively broad shells, but these cannot be named without definite locality, which should have been available in the first instance.

CANEFRIULA TAUMANTIAS Tapparone-Canefri, 1883.

1883. *Helix taumantias* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 141, pl. 3, fig. 13, 14, pl. 6, fig. 4, pl. 9, figs. 16 and 18 (dated June 26). Fly and Katow Rivers, Papua.

CANEFRIULA CINGULATA Hedley, 1891.

(Plate iii., fig. 15.)

1891. *Geotrochus taumantias* var. *cingulatus* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 93, September 9. Aipiana, St. Joseph River, Hall Sound, Papua.

CANEFRIULA ROLANDI *sp. nov.*

(Plate iii., fig. 13.)

A nice series sent by Mr. R. Oldham from behind Port Moresby represents a species not previously seen from that locality, being a flattened

relation of *tomasinelliana*, being of the same peculiar style of coloration, but with the columella greatly expanded and bearing in front a strong dentiform bulge. The type measures 44 mm. broad by 29 mm. high. The strong sculpture of *tomasinelliana* is present in a modified state, and the present species has the very rounded whorls and coloration of the series, *brazierae, hixsoni, cynthia* and *lacteolota*, which may constitute a natural subgenus.

Genus CLAUDETTEA *nov.*

Type, *Helix bevani* Hedley.

This very beautiful shell cannot be confounded with any other in this faunula, and its exact relationship is not very clear. Shell large, flattened, strongly keeled, mouth open, broad, lip reflected, perforate. Spire short and conical, sculpture of fine radial striae.

CLAUDETTEA BEVANI Hedley, 1891.

(Plate iii., fig. 17.)

1891. *Helix bevani* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 85, pl. xi., figs. 22-23, September 9, ex Brazier MS. Douglas River, British New Guinea.

The original specimen, now in the Australian Museum, is a large dead shell which has been broken and repaired, but it was of such striking appearance that it demanded description. A very beautiful younger specimen was collected by Donald Mackay from the Upper Purari River, and it is pale brown with the lips of the mouth dull red and is here figured.

CLAUDETTEA ELISA Hedley, 1891.

1891. *Geotrochus elisus* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 86, pl. xi., figs. 24-25, September 9. British New Guinea (Goldie).

This differs from the preceding in its more open umbilicus, its smaller mouth, size, and different colour scheme, and until more is known about it it may be allotted to a new subgenus, *Claudena*.

Genus RHYNCHOTROCHUS Möllendorff, 1895.

1895. *Rhynchotrochus* Möllendorff, Proc. Mal. Soc. (Lond.), Vol. i., p. 237, March. Orthotype, *Papuina tayloriana* Adams & Reeve.

This group has given more trouble than all the other Papuan shells, as the similarity of the species is confusing, although series from any given locality appear uniform. The length of the beak and coloration of the lips are also misleading, and have led to extreme views. Thus, while Hedley was inclined to lump everything into one species, Möllendorff recorded two species and a variety from one locality. After examination of specimens from some twenty localities, a conservative view is attempted with provision for ample revision.

RHYNCHOTROCHUS TAYLORIANUS Adams & Reeve, 1850.

(Plate iv., fig. 1.)

1850. *Helix tayloriana* Adams & Reeve, Zool. Voy. Samarang, Vol. ii., p. 59, pl. xv., figs. 2a-b, August. No locality = Port Moresby here selected from comparison of shells.

After long and careful consideration, Hedley's suggestion that the shell was collected by John Macgillivray is accepted. Specimens collected by Mr. R. Oldham, behind Port Moresby, agree very closely with the figure, and therefore Port Moresby is here fixed as the type locality. Using this species as a basis, the other Papuan species can be described and determined.

The type is a low conical shell with the mouth attenuated into a long beak, the upper lip bending sinuously down and then up again to form the beak, dark brown red, the shell being pale pink in the earlier whorls changing into lemon on the last, and measuring 32 mm. in breadth, and 18.5 mm. in height.

RHYNCHOTROCHUS YULENSIS Brazier, 1876.

1876. *Helix* (*Geotrochus*) *yulensis* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 105, July. Yule Is. Figured, Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 123, pl. iii., fig. 2, pl. vi., fig. 1, pl. viii., fig. 11 (dated June 25), 1883, and Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vii., p. 59, pl. 2, figs. 29-31, 1891.

This species is unlike the preceding in the shorter beak of the more open mouth recalling that of *Henga*, and it may be that it is a relative of that genus rather than congeneric with *Rhynchotrochus*. This appears to be confirmed by the presence in the same locality of a long-beaked species.

RHYNCHOTROCHUS STRABO Brazier, 1876.

1876. *Helix* (*Geotrochus*) *strabo* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 106, July. Katow River, Papua.

1883. *Helix katauensis* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 126, pl. iii., figs. 1-3, pl. vi., fig. 3 (dated June 25). Katau, Papua.

RHYNCHOTROCHUS ROSEOLABIATUS Smith, 1887.

1887. *Helix* (*Papuina*) *roseolabiata* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 421, June. Fergusson Is.

A long-beaked form with pale lips, measuring 30½ mm. broad by 19 mm. high, and with the mouth contracted medially. The coloration probably attracted Smith, as it is a deep cream with a crimson peripheral band.

RHYNCHOTROCHUS MONTICOLA *sp. nov.*

(Plate iv., fig. 2.)

Shell small, imperforate, broadly conical, spire with whorls flattened but a little convex, periphery sharply angulate, base evenly rounded, mouth comparatively small, beak short, upper lip slightly sinuate, lower rounded, columella thin, appressed, lips thin, brown-red. Shell coloration, apical whorl blackish, succeeding whorls pinkish, densely mottled with dull purplish, the dark colouring following the wavy sculpture, cream peripheral band present, base with a couple of dark spiral bands. Breadth, 27 mm.; height, 19 mm.

Mount Astrolabe, Papua.

RHYNCHOTROCHUS PRAEFECTUS *sp. nov.*

(Plate iv., fig. 3.)

Shell larger, imperforate, broadly conical, with whorls little rounded, sutures deeper, periphery angulate, base rounded, swollen towards aperture, mouth large, open, upper lip sinuate, beak short, lower lip convex, columella thickened, appressed, pink glaze connecting with outer lip, lip brown-red. Shell coloration, apical whorl bluish, later whorls creamy with freckling as in preceding species, also subperipheral whitish band, base with several brownish-red bands. Breadth, 33 mm.; height, 22.5 mm.

Collingwood Bay, North-east Papua.

RHYNCHOTROCHUS SINUCOLA *sp. nov.*

(Plate iv., fig. 4.)

Shell medium, imperforate, broadly conical with whorls rather flattened,

sutures lightly impressed, periphery sharply angulate, base rounded, not swollen, mouth small, open, beak short, upper lip wavy, lower lip squarish basally, columella rather flexuous, thin, appressed. Dead shell, but showing coloration to be similar to that of the preceding, with lips probably pale. Breadth, 29 mm.; height, 18 mm.

Cloudy Bay, south coast of Papua.

RHYNCHOTROCHUS VALLICOLA *sp. nov.*

(Plate iv., fig. 5.)

Shell medium, broadly conical, imperforate, spire shortly conical, whorls little convex, periphery acutely angulate, base rounded, a little swollen towards the aperture, mouth long and narrow, upper lip sinuate and bent forward, cramping the opening and attenuated into a shallow spout, the lower lip flattened, the columella curved, not much thickened, and appressed. Coloration similar to that of the preceding, but much darker in every item, except the lips, which are pale rosy. Breadth, 30 mm.; height, 17 mm.

Purari River, Papua.

RHYNCHOTROCHUS EXTRANEUS *sp. nov.*

(Plate iv., fig. 6.)

Shell large, broadly conical, imperforate, spire shortly conical, whorls somewhat convex, sutures well marked, periphery sharply angulate, base very rounded, swollen towards the aperture, mouth broad and long, very open, upper lip with a strong sinuation ending in a short beak, lower lip rounded, columella very thin, appressed. Coloration uniform pale pinkish white, lips pale rose. Breadth, 30 mm.; height, 18 mm.

Kerema, Gulf of Papua.

RHYNCHOTROCHUS MYSTICUS *sp. nov.*

(Plate iv., fig. 7.)

A shell was figured by Smith (Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 421, pl. xv., fig. 1a, June, 1887) as from South Cape, ex Brazier. Specimens from the same lot are before me, and it recalls *Henga trobriandensis*, but has the outer lip sinuate. Shell small, conical, whorls rather convex, periphery scarcely angulate, base very rounded, mouth very open, upper lip sinuate, beak short, under lip rounded, columella thin, appressed. Coloration as in *monticola*, lips red-brown. Breadth, 26 mm.; height, 20 mm.

Genus LETITIA *nov.*

Type, *Helix brumeriensis* Forbes.

Shell heliciform, spire short, whorls round, faintly subkeeled, mouth open large, as broad as high, lip reflected all round, upper lip scarcely sinuate, columella broad, flattened, eliminating umbilicus, hence shell imperforate, sculpture of fine grains arranged spirally. Radular formula, 110 x 40.7.1.7.40.

LETITIA BRUMERIENSIS Forbes, 1851.

1851. *Helix brumeriensis* Forbes, Voy. Rattlesnake, Vol. ii., p. 375, pl. 2, figs. 1a-b, "1852" = December, 1851. Brumer Is., Papua.

In the typical species the callus joining the outer and inner lip across the body whorl is black. A similar shell from the mainland at Port Glasgow, and recorded by Smith from Millport Harbour, many years ago, is larger and more conical, measuring 38 mm. broad by 33 mm. high, while the type measured 28 mm. broad by 24 mm. high. This may be named *Letitia adjuncta* sp. nov. (Plate iv., fig. 8). Hedley recorded specimens from Milne

Bay, Papua, and these are broadly conical shells, in which the blackish-red outer lip is separated from the similarly coloured columella by a thin white glaze on the body whorl. This may be named *L. interrupta* sp. nov., the type measuring 37 mm. in breadth by 29 mm. in height. (Plate iv., fig. 9.) A series collected on Moturina, one of the Calvados Chain, Louisiades, by the Rev. H. K. Bartlett, consists of smaller shells, more depressed and with a thickened blackened outer lip and columella, boldly interrupted by white on the body whorl, and may be called *L. moturina* sp. nov., the type measuring 31 mm. broad by 22 mm. high. (Plate iv., fig. 10.)

LETITIA ALBOLABRIS Hedley, 1891.

(Plate iv., fig. 11.)

1891. *Geotrochus brumeriensis* var. *albolabris* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 89, September 9. Mita, Milne Bay, Papua.

This, introduced as a white-lipped variation only, proves to be a well-marked species with several relations. The type is smaller than the Milne Bay "*brumeriensis*" = *interrupta*, but comparatively narrower, with the lip entirely white and a thickened callus connecting the outer and inner lip; it measures 34 mm. in breadth by 29 mm. in height.

A large number of specimens, presented by the Rev. H. K. Bartlett from Panapompom, in the Deboyne Group, agrees in general coloration, but the shells are smaller, less conical, measuring 30 mm. in breadth by 21 mm. in height. This may be called *L. maria* sp. nov. (Plate iv., fig. 12.).

From Tube Tube, Engineer Group, another series is composed of small, thin, heavily freckled specimens, measuring 26 mm. in breadth by 20 mm. in height; these have the ground colour chalky white with pale green zig-zag rows and blotches, and the immature phases of the preceding species show the same coloration, but the adult is usually, in the other species, more or less uniform white. This species may be named *L. degener* sp. nov. (Plate iv., fig. 13.).

Probably other island species will later be named as a large series from Panneati, close to Panapompom, also collected by the Rev. H. K. Bartlett, agrees with *maria*, but a lot from Kevalaiwa, an island off the East Cape, collected by the Rev. H. T. Williams, shows variation.

SACCOLETITIA *subgen. nov.*

The larger size, different coloration, and especially the distinct radular formula of 153 x 42.10.1.10.42, make it necessary to distinguish the following species (*zeno*) with a new subgeneric name *Saccoletitia*.

LETITIA ZENO Brazier, 1876.

1876. *Helix* (*Geotrochus*) *zeno* Brazier, Proc. Linn. Soc. N.S.W., Vol. i., p. 107, July. Hall Sound, Brit. New Guinea. Fig. Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 88, pl. xi., fig. 27, 1891, and by Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vii., p. 53, pl. i., figs. 2-4, 1891.

1893. *Helix zeus* Smith, Conchologist, Vol. ii., p. 108, March 25. Error only.

LETITIA LATIAXIS Smith, 1883.

1883. *Helix* (*Geotrochus*) *latiaxis* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xi., p. 191, March. "D'Entrecasteaux Is." Error = Foot of Mt. Astrolabe, fide Brazier. Figd. Smith, id., Vol. xix., p. 420, pl. 15, fig. 7, June, 1887.

LETITIA SUBGLOBOSA Fulton, 1902.

(Plate iii., fig. 14.)

1902. *Papuina zeno* var. *subglobosa* Fulton, Ann. Mag. Nat. Hist., Ser. 7, Vol. ix., p. 184, March. Port Moresby, Papua (Emil Weiske).

Genus CAROLETITIA *nov.*

Type, *Helix diomedes* Brazier.

Recalling *Pompalabia* from above, but has the open mouth and sculpture of *Letitia*, and the strong peripheral keeling is a distinctive feature. Shell conical, depressed, solid, strongly keeled, mouth open, lip reflected, expanded basally, columella broad, appressed, closing the umbilicus, lips joined, sculpture smoothish, growth lines crossing spiral rows of minute grains.

CAROLETITIA DIOMEDES Brazier, 1877.

1877. *Helix diomedes* Brazier, Proc. Linn. Soc. N.S.W., Vol. ii., p. 121, July. "Brumer Is. Error = Coutance Is., fide Brazier himself. Figd. Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 122, pl. iii., fig. 12, 1883, and Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vii., p. 54, pl. i., figs. 9-10, 1891.

CAROLETITIA VILIA *sp. nov.*

(Plate iv., fig. 14.)

Mr. Melbourne Ward collected a shell at Vilirupu, south coast of Papua, which is taller and narrower, with the last whorl steeply descending and almost forming a continuous mouth. The type measures 30 mm. in breadth by 25 mm. in height.

CAROLETITIA SECANS Hedley, 1894.

1894. *Papuina secans* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. ix., p. 389, pl. xxv., figs. 8-9, December 10. Mt. Maneao, north coast, Papua.

[Cf. 1897. *Helix* (*Papuina*) *linterae* Möllendorff, Nachr. d. mal. Gesell, 29th Year, p. 30, March-April No. New Guinea. See Ancey, Journ. de Conch., Vol. lii., p. 311, December 25, 1904.]

Genus POMPALABIA *nov.*

Type, *Helix naso* Martens.

Large flattened conical Papuinid, strongly keeled, mouth with the upper lip bidentate and descending, cramping the entrance, followed behind by a depression and strong crest, imperforate, sculpture of wavy wrinkling.

POMPALABIA NASO Martens, 1883.

1883. *Helix naso* Martens, Jahrb. d. Malak. Gesell, Vol. x., p. 82, January-Feb. Taburi, Astrolabe Bay (error for Mts.), South East New Guinea. Figd. Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vii., p. 56, pl. 2, figs. 32-35, 1891.

1883. *Helix* (*Geotrochus*) *tapparonei* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xi., p. 190, March. "D'Entrecasteaux Is." Error = Foot of Mt. Astrolabe.

1884. *Helix hunsteini* Brazier, Proc. Linn. Soc. N.S.W., Vol. ix., p. 805, November 29, as synonym of *H. tapparonei* Smith, ex *Helix hundsteini* (sic) Brazier, Proc. Linn. Soc. N.S.W., Vol. v., p. 637, May 20, 1881, *nomen nudum*.

POMPALABIA GEMINA Fulton, 1902.

1902. *Papuina gemina* Fulton, Ann. Mag. Nat. Hist., Ser. 7, Vol. ix., p. 183, March. River Arva (= Aroa), 5,000 ft., Papua (Emil Weiske).

POMPALABIA MEEKIANA Smith, 1905.

1905. *Papuina meekiana* Smith, Ann. Mag. Nat. Hist., Ser. 7, Vol. xvi., p. 193, fig. in text, August. Owgarra, An(g)abunga River, Owen Stanley Range, 8,000 ft., Papua.

Genus HENGA *nov.*

Type, *Geotrochus trobriandensis*, Hedley.

Shell subconical, thin, subkeeled, imperforate, mouth open, upper lip contracted, sinuate, mouth about as broad as high, columella thin, appressed, sculpture of wavy wrinklings above, sometimes fine spirals below. Radular formula, 154 x 55.8.1.8.55.

HENGA TROBRIANDENSIS Hedley, 1891.

1891. *Geotrochus trobriandensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 92, pl. xi., fig. 28, September 9. Trobriand Is.

This may be

1887. *Helix* (*Papuina*) *albocarinata* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 422, pl. 15, fig. 12, June. "South Cape" error.

HENGA WILLIAMSI Clench & Archer, 1936.

1936. *Papuina williamsi* Clench & Archer, Nautilus, Vol. 49, p. 88, pl. 5, fig. 4, January. Omara Kana, Central Kiriwina, Trobriand Is.

1936. *Papuina williamsi atalanta* Clench, Nautilus, Vol. 50, p. 53, October. Same locality.

The exact status of these forms is in doubt.

HENGA DELICIOSA *sp. nov.*

(Plate iv., fig. 15.)

A beautiful little species was brought in by the Rev. H. K. Bartlett from the Laughlan Islands, more depressed, much smaller, thinner, whorls rounded, last whorl peripherally keeled, base rounded, mouth oval, open, lip little thickened, pink, columella thin, coloration, pellucid with opaque cream zigzag markings, the type measuring 18 mm. broad and 11 mm. in height.

Genus VIOLENGA *nov.*

Type, *Helix rollsiana* Smith.

Shell depressed, heliciform, solid, imperforate, periphery rounded, mouth open, lengthened, broader than high, upper lip a little sinuate extending into a short open beak, columella thin, appressed, sculpture of wavy wrinklings, coloration peculiar of violet mottling. Radular formula, 154 x 45.10.1.10.45; *louisiadensis*, 142 x 45.9.1.9.45; and *woodlarkiana*, 130 x 42.9.1.9.42.

VIOLENGA ROLLSIANA Smith, 1887.

1887. *Helix* (*Papuina*) *rollsiana* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 423, pl. 15, fig. 3, June. "South Cape" error = Seymour Bay, Fergusson Is.

1941. *Papuina bartletti* Cotton, South Austr. Nat., Vol. 21, p. 5, figs. in text, May 31. Salamo, Fergusson Is.

VIOLENGA MISIMA *nom. nov.*

(Plate iv., fig. 16.)

1889. *Helix* (*Geotrochus*) *thomsoni* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 202, pl. 13, figs. 12-13, September. St. Aignan = Misima, Louisiade Group. Not *Helix thomsoni* Pfeiffer, Mal. Blatt., 1871, p. 120.

VIOLENGA MILLICENTAE Cox, 1871.

1871. *Helix millicentae* Cox, Proc. Zool. Soc. (Lond.), 1871, p. 323, pl. xxxiv., figs. 2-2a, August 16. Louisiade Is.

VIOLENGA LOUISIADENSIS Forbes, 1851.

1851. *Helix louisiadensis* Forbes, Voy. Rattlesnake, Vol. ii., p. 376, pl. i., fig. 8a, "1852" = December, 1851. South East Is., Louisiades.

VIOLENGA WOODLARKIANA Souverbie & Montrouzier, 1863.

1863. *Helix woodlarkiana* Souverbie & Montrouzier, Journ. de Conch., Vol. xi., p. 76, January 1; p. 172, pl. 5, fig. 2, April 1. Woodlark Is.

Note: *Helix comriei* Angas (Proc. Zool. Soc. (Lond.), 1876, p. 489, pl. xlvii., figs. 4-5), from Huon Gulf, North Coast, seems to belong to this series.

Genus KATHADENA *nov.*

Type, *Helix gurgustii* Cox.

Looks like an elevated relative of *Violenga* with similar sculpture, but strongly keeled periphery; the mouth similar, a little narrower and subattenuated to a spout recalling *tayloriana*, upper lip sinuate expanded all round, the lower expanded, merging into small straight columella. Anatomy distinct and radular formula, 145 x 47.10.1.10.47.

KATHADENA GURGUSTII Cox, 1879.

1879. *Helix* (*Geotrochus*) *gurgustii* Cox, Proc. Linn. Soc. N.S.W., Vol. iv., p. 114, pl. 16, fig. 1, June 16. Rossel Is. Figured, id. ib., Ser. 2, Vol. ii., p. 1,062, pl. 21, figs. 3-4, 1888.

Genus ZENOLINA *nov.*

Type, *Helix chapmani* Cox.

Shell conical, tall, thin, imperforate, subkeeled, mouth open, higher than broad, lip a little expanded, columella broad flattened, sculpture of wavy wrinkling. The very open mouth is characteristic, otherwise this species might be regarded as an elevated relation of the *Violenga* series. Radular formula, 138 x 32.6.1.6.32, is also peculiar.

ZENOLINA CHAPMANI Cox, 1879.

1879. *Helix* (*Geotrochus*) *chapmani* Cox, Proc. Linn. Soc. N.S.W., Vol. iv., p. 115, pl. 16, fig. 2, June 16. Rossel Is. Refigured, id. ib., Ser. 2, Vol. ii., p. 1,063, pl. 21, figs. 10-11, 1888.

1887. *Helix* (*Acavus*) *coraliolabris* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 419, pl. xv., fig. 4, June. Russell = Rossel Is.

ZENOLINA CHILOCHROA Costa, 1899.

1899. *Papuina chilochroa* Costa, Proc. Mal. Soc. (Lond.), Vol. iii., p. 306, fig. in text, October. British New Guinea.

Genus LULLICOLA *nov.*

Type, *H. boyerii* Fischer & Bernardi.

Resembling the preceding but with lip thinner and less reflected and coloured, suggesting that it is an elevated development from the *Henga* series. A curious convergence is seen in the radular formula which is 104 x 33.6.1.6.33.

LULLICOLA BOYERII Fischer & Bernardi, 1857.

1857. *Helix boyerii* Fischer & Bernardi, Journ. de Conch., Vol. v., p. 297, pl. 9, figs. 8-9, January. "Admiralty Is." error = Woodlark Is.

Genus TEPOMUSA *nov.*

Type, *Helix canovarii* Tapparone-Canefri.

Shell tall, conical, spire elevated, whorls flattened, sutures lightly im-

pressed, peripheral keel strong, base flattened, little rounded, lip scarcely descending, mouth rather squarish, lips scarcely reflected, columella reflected concealing umbilical chink; this is the same in the juvenile.

TEPOMUSA CANOVARII Tapparone-Canefri, 1883.

1883. *Helix canovarii* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 131, pl. iii., fig. 6 (dated June 26). Fly River, Papua.

A series of specimens from the Purari Valley from juvenile to adult differs in the more convex whorls, the more obtuse apex, the more open mouth, the outer lip not descending, while the coloration is pale brown with the lips white. This may be called *Tepomusa confirma* sp. nov., the type measuring 23 mm. in breadth and 25 mm. in height. (Plate iv., fig. 17.).

Genus NEGOTOBBA *nov.*

Type, *Helix goldiei* Brazier.

Shell large, solid, lentiliform, periphery acutely angulate, spire whorls flattened, sutures little impressed, last whorl descending a little, mouth small, oval, beaked, upper lip wavy, thickened and slightly expanded, underlip broadly reflected, columella also very broad almost hiding narrow deep open umbilicus, a thin callus connecting with outer lip, sculpture of irregular wavy ripple marks, apex smooth, coloration of purple and green blotches and scrolls, quite characteristic. The general appearance is of the North Australian *Meliobba* which is imperforate, has the lips more expanded and a little less beaked mouth and paler colour scheme.

NEGOTOBBA GOLDIEI Brazier, 1884.

1884. *Helix* (*Obba*) *goldiei* Brazier, Proc. Linn. Soc. N.S.W., Vol. ix., p. 804, November 29 (ex *Helix goldei* Brazier, Abst. Linn. Soc. N.S.W., of December 29, 1880, issued January 27, 1881, *nomen nudum*; and Proc. Linn. Soc. N.S.W., Vol. v., p. 637, May 20, 1881, *nomen nudum*), new name for

1883. *Helix* (*Obba*) *oxystoma* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xi., p. 191, March. D'Entrecasteaux Is., error = foot of Astrolabe Range, Papua, fide Brazier. Not *Helix oxystoma* Thomas, Jahrb. Ver. Nat. Nassau, Vol. ii., p. 136, 1845. Fig. Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vi., p. 217, pl. 58, figs. 37-38, May 1, 1891, and Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 86, pl. x., fig. 20, pl. xi., fig. 21, September 9, 1891.

Through breakage the shells are commonly distorted, some specimens very flattened and others with the spire elevated, being met with in the same locality. The species has been recorded by Gude (Proc. Mal. Soc. (Lond.), Vol. vii., p. 114, June 29, 1906), from Dinawa, collected by E. A. Pratt, and specimens from Cloudy Bay, collected by A. C. English, are before me, but through the abovementioned variation, at present, these appear inseparable.

A very similar species has been named *Helix* (*Papuina*) *lintschuana* by Kobelt (Syst. Conch. Cab., Bd. I., Abth. xii., p. 701, pl. 200, figs. 5-6 (dated 26/8/'94), 1897 ?), from Djamna Is., Humboldt Strait, North Coast of New Guinea.

Note: Pilsbry (Man. Conch. (Tryon), Ser. 2, Vol. ix., p. 139, 1894) has recorded—"The great variation observed in the genitalia and teeth of the species examined, shows that here lies a wide field for future cultivation. These features are no doubt characteristic of minor groups in the genus, and their investigation will lead to valuable results in the classification

of the group, and secondarily may be of use in the study of its geographical distribution and migrations".

No one in the half century that has nearly passed has taken up this challenge.

Although Pilsbry separated some fifteen groups in his genus *Papuina* half a century ago, little has been done to rectify the anomalies since, so that an attempt is here made by indicating some of more notable groups as genera, a complete revision being impossible at the present time.

SOLMOPINA gen. nov. Type, *Helix boivini* Petit. Solomon Group.

Shell broadly conical, spire tall, whorls rounded, imperforate, columella reflected, mouth open, outer lip rounded thin, not reflected, no wrinkly sculpture, shell banded.

SOLMOPESTA gen. nov. Type, *Helix meta* Pfeiffer. Solomon Group.

Similar to preceding, taller, narrower, whorls flattened, very narrowly perforate, columella straight, strongly reflected, concealing umbilicus, outer lip not reflected, thin, no wrinkly sculpture.

SOLMOGADA gen. nov. Type, *Helix flexilabris* Pfeiffer. Solomon Group.

Similar to *Solmopina*, whorls rounded, imperforate, mouth open, lip broadly expanded, sculpture wrinkly.

SOLMODORA gen. nov. Type, *Helix mendoza* Brazier. Solomon Group.

Similar, whorls rounded, but periphery strongly keeled, hence, though mouth open, it is somewhat triangular in form. Radular formula (*fulakorensis*), 100 x 110.1.110, Clapp.

PINNADENA gen. nov. Type, *Helix lombei* Pfeiffer. Solomon Group.

Shell more flattened, the last whorl subkeeled, sculpture not wrinkling, mouth oval, upper lip thin, scarcely expanded, columella broadly reflected, subdenticulate.

MOLMEROPE gen. nov. Type, *Helix pileus* Müller. Moluccas.

Shell tall, narrowly conical, striate, whorls rounded, base a little flattened, minute perforation, mouth open, lip thin, little reflected, columella much reflected, concealing umbilicus.

HOMBRONULA gen. nov. Type, *Helix horderi* Sowerby. New Guinea.

Shell tall, whorls rounded, periphery well rounded as is base, mouth broad, very open, lip reflected all round, columella reflected almost closing umbilicus; projecting tooth at base of columella.

CARMEROPE gen. nov. Type, *Helix pileolus* Ferussac. Moluccas.

Shell tall, conical, whorls flattened, strongly keeled, base flattened, perforate, mouth open, oblong, lip strongly reflected all round, bluntly recurved beak, columella smooth.

ZETEMINA gen. nov. Type, *Helix hedleyi* Smith. New Guinea.

Larger, similar in form, but lip thin, little thickened and lengthened into a beak, columella bearing a notable denticle.

SMEATONIA gen. nov. Type, *Helix eddystonensis* Reeve. Solomon Group.

Shell flattened, conical, perforate, mouth very open, lip widely reflected, lower lip broad, and columella much expanded, concealing umbilicus, sculpture wrinkly.

EMIRALENA gen. nov. Type, *Helix moseleyi* Smith. Admiralty Is.

Shell flattened, large nuclear smooth whorls, few adult whorls rounded, imperforate, mouth open, lip reflected all round, wrinkly sculpture, columella little reflected.

Lisprelia gen. nov. Type, *Helix novaegeorgiensis* Cox. Solomon Group.

Shell superficially resembling the preceding, but apical whorl larger, columella subdentate, similarity apparently due to convergence only, imperforate, sculpture of corrugations.

Solmotella gen. nov. Type, *Helix fringilla* Pfeiffer. Solomon Group.

Shell solid, depressedly globose, imperforate, mouth constricted, oblique, lip reflected, columella subdenticulate, surface not wrinkly.

Municeps gen. nov. Type, *Helix redempta* Cox. Solomon Group.

Shell solid, spire convex, imperforate, mouth rhomboid, columella dentate, outer lip thin, lower lip convex.

Family Chloritidae.

Many years ago Pilsbry attempted to link a heterogeneous assemblage together by means of the supposed sculpture of the apical whorls—"a quincuncially granulated apex" as the true generic criterion,—a very futile expedient. The original *"Chloritis"* was a flattened shell of very rounded whorls, a concave spire, narrow deep umbilicus, mouth crescentic, higher than broad, lip a little expanded, shell with a pilose periostracum, somewhat deciduous and missing in the adult. The suggestion that a granulose apex was paramount allowed the addition of many unlike shells until the mass become a discordant congregation. Now Clapp has provided a sensation by separating very similar shells by means of anatomical examination.

A critical examination of extralimital species became necessary as the Papuan *dinodeomorpha* was the one segregated by Clapp from the conchologically very similar *eustoma*, the type of *Eustomopsis*.

Genus Disteustoma *nov.*

Type, *Helix dinodeomorpha* Tapparone-Canefri.

Shell subglobose, spire flattened, even a little elevated, sometimes depressed, umbilicus deep but very narrow, almost occluded by the reflexed columella, otherwise shell characters as in *Eustomopsis*, but animal characters very different, according to Clapp (Bull. Mus. Comp. Zool., Harvard, Vol. lxv., p. 381, November, 1923).

Disteustoma dinodeomorpha Tapparone-Canefri, 1883.

1883. *Helix dinodeomorpha* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 168, pl. 4, figs. 4, 7, pl. 7, fig. 5, pl. 9, figs. 2, 15 (dated July 5). Fly River, Papua.

Disteustoma nema *sp. nov.*

(Plate iv., fig. 18.)

A beautiful shell from the Purari Valley, determined by Hedley as *dinodeomorpha*, has the whorls more tightly coiled, the mouth much larger and not descending as much, the umbilicus wider, and the hairs longer and not so closely spaced. This measures 29 mm. in breadth and 18 mm. in height.

Disteustoma leei Cox, 1873.

1873. *Helix leei* Cox, Proc. Zool. Soc. (Lond.), 1873, p. 565, pl. 48, figs. 5-5a, November. Louisiade Is. = Misima (Smith). Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 687, pl. xxxix., figs. 13, 15, pl. 40, fig. 23 (Anat.). Radula formula, 167 x 40.17.1.17.40. June 10, 1892.

Disteustoma woodlarkensis Hedley, 1891.

1891. *Chloritis leei* var. *woodlarkensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 83, September 9. Woodlark Is.

1897. *Chloritis fuscopurpurea* Smith, Proc. Mal. Soc. (Lond.), Vol. ii., p. 289, pl. xvii., figs. 12-14, November. Woodlark Is.

DISTEUSTOMA SUDESTENSIS Hedley, 1891.

1891. *Chloritis leei* var. *sudestensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 83, September 9. Sudest Is., Louisiades.

DISTEUSTOMA PAPUENSIS Hedley, 1891.

1891. *Chloritis leei* var. *papuensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 83, September 9. Mita, Milne Bay, Papua.

1936. *Chloritis delphax* Clench, Nautilus, Vol. 50, p. 53, October. Huhuna, 20 miles west of East Cape, Papua. Not *Helix* (*Chloritis*) *delphax* Nachr. d. malak. Gesell, Vol. xxiii., p. 214, 1891, ex Dohrn MS, Astrolabe Bay, North Coast, New Guinea. Figured by Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p. 648, pl. 186, figs. 5-7, 1897.

DISTEUSTOMA EPHAMILLA Smith, 1895.

1895. *Helix* (*Chloritis*) *ephamilla* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 232, March 1. Brit. New Guinea (northern islands ?). Fig., Smith, ib., Vol. xvi., p. 363, pl. 20, fig. 10, November, 1895. Figd. Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p. 823, pl. 223, figs. 7-8, 1897. Fergusson Is.

DISTEUSTOMA NEPHELE Strubell, 1895.

1895. *Helix* (*Chloritis*) *nephele* Strubell, Nachr. d. malak. Gesell., 27th Year, p. 151, September-October. Cloudy Mts., British New Guinea, 2,500 ft. Figd. Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p.822, pl. 223, figs. 5-6, 1897.

Genus TRADEUSTOMA *nov.*

Type, *Helix subcorpulentus* Smith.

Shell large, depressed, globose, spire flattened, little elevated, last whorl very large, mouth very large, subcircular, lips joind by a callus, columella expanded, umbilicus narrow deep, umbilical area subkeeled, apical whorls pustulate, early whorls apparently showing distant hair scars, last whorl hairless, sculptured with radial growth lines.

TRADEUSTOMA SUBCORPULENTA Smith, 1891.

1889. *Helix* (*Chloritis*) *subcorpulentus* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. iv., p. 201, pl. 13, fig. 14, September 1. Rossel Is.

Genus ALEATELIX *nov.*

Type, *Helix stirophora* Smith.

Shell medium, stout, depressedly turbinate, spire whorls convexly elevated, whorls flattened, periphery subkeeled, base rounded, mouth large, broader than high, lip not descending, outer lip thinnish reflected a little, columella curved broadly reflected over the open umbilicus. Apical whorls almost smooth, sculpture of adult whorls radial growth lines only. Conchologically quite unlike a Chloritid.

ALEATELIX STIROPHORA Smith, 1895.

1895. *Helix* (*Hadra*) *stirophora* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 231, March. Cloudy Bay, South Coast, Papua. Figd. id. ib., Vol. xvi., p. 363, pl. 20, fig. 9, November, 1895. Anat., Moss & Webb, Journ. Malac., Vol. v., p. 33, pl. iii., figs. 1-7, September 30, 1896 (where from study of anatomy conclude the species is Chloritid).

ALEATELIX COLLINGWOODENSIS Preston, 1902.

1902. *Chloritis* (*Sulcobasis*) *stirophora* var. *collingwoodensis* Preston, Proc.

Mal. Soc. (Lond.), Vol. v., p. 17, fig. 5 in text, April 23. Collingwood Bay, British New Guinea.

Genus GEMITELIX *nov.*

Type, *Helix perambigua* Smith.

Shell more conical, even more "Helicoid" than preceding, whorls more rounded, sutures deep, outer lip a little reflected, columella expanded, surface smooth.

GEMITELIX PERAMBIGUA Smith, 1895.

1895. *Helix* (*Chloritis*) *perambigua* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 233, March. "Northern Papua". Figured, Smith, id. ib., Vol. xvi., p. 363, p. 20, fig. 11, November, 1895.

Genus SULCOBASIS Tapparone-Canefri, 1883.

1883. *Sulcobasis* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 161 (dated July 5). Orthotype, *Helix sulcosa* Pfeiffer.

SULCOBASIS BEATRICIS Tapparone-Canefri, 1883.

1883. *Helix beatricis* Tapparone-Canefri, Ann. Mus. Civ., Genova, Vol. xix., p. 163, pl. 4, fig. 14, pl. 8, fig. 16 (dated July 5). Fly River, Papua.

Genus GOLDIELIX *nov.*

Type, *Helix rehsei* Martens.

The shell more globose than that of the preceding, the apical whorls large, the lips of the mouth greatly expanded, the mouth itself being nearly circular, umbilicus moderate to small. Sculpture of early whorls punctate as if bases of hairs, last whorl apparently hairless, not sulcate. Radula formula, 224 x 46.20.1.20.46.

GOLDIELIX REHSEI Martens, 1883.

1883. *Helix rehsei* Martens, Jahrb. d. malak. Gesell., Vol. x., p. 83, January. Taburi, Astrolabe Range, Papua. Figd., Syst. Conch. Cab., Bd. I., Abth. xii. (*gerrardi*), p. 643, pl. 185, figs. 1-2, 1897 (cf. p. 680, index to plates).

1883. *Helix* (*Sphaerospira*) *gerrardi* Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xi., p. 192, March. "D'Entrecasteaux Is." error = inland from Port Moresby, fide Brazier, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. ix., p. 804, 1884. Figd. Smith, Ann. Mag. Nat. Hist., Ser. 5, Vol. xix., p. 418, pl. 15, fig. 14, September, 1889.

GOLDIELIX NEPTIS *sp. nov.*

(Plate iii., fig. 21.)

Shell subglobose, spire little elevated, rather widely openly umbilicated, mouth rather small, subcircular, coloration of shell pale red, covered by a thin brown periostracum, lips white, umbilicus bordered by a semi-keel; the shell measuring 47 mm. in breadth by 35 mm. in height, from Cloudy Bay. This is apparently not *Helix obtecta* Reinhardt, Sitz. Ges. Nat. Fr., Berlin, No. 4, figs. 58-59, 1886, from South Cape, but that name is invalidated by *Helix obtecta* Lowe, Tr. Camb. Phil. Soc., Vol. iv., p. 47, 1831, and Anton in Rossmassler, 1839 (Sherborn).

GOLDIELIX MERACA *sp. nov.*

(Plate iii., fig. 20.)

Specimens from Fergusson Island have the narrow umbilicus almost concealed as in *mita*, but the spire is flatter, the shell is smaller, less globose, mouth much smaller, lip less expanded and coloured bluish, the

shell being bright red brown, and measuring 48 mm. in breadth, and 34 mm. in height.

These were apparently described as *Helix* (*Sphaerospira*) *anceps* Strubell, Nachr. d. malak. Gesell., 27th Year, p. 150, September-October, 1895, figured by Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p. 821, pl. 223, figs. 1-2, 1897, but the name is unavailable through the prior usage by Gould, Proc. Bost. Soc. Nat. Hist., Vol. i., p. 139, 1843.

GOLDIELIX MINNIGERODEI Strubell, 1895.

1895. *Helix* (*Sphaerospira*) *minnigerodei* Strubell, Nachr. d. malak. Gesell., 27th Year, p. 150, September-October, 1895. Normanby Is. Figd. Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p. 822, pl. 223, figs. 3-4, 1897 (dated 25/8/'95, not issued until 1897).

GOLDIELIX FRAUDULENTA Gude, 1906.

1906. *Chloritis fraudulenta* Gude, Proc. Mal. Soc. (Lond.), Vol. vii., p. 107, pl. xiii., fig. 4, June 29. Dinawa, 3,600 ft., inland from Hall Sound, Papua (E. A. Pratt).

GOLDIELIX MITA *sp. nov.*

(Plate iii., fig. 19.)

Hedley recorded *gerrardi* from Mita, Milne Bay, but later regarded them as *obtecta*. Shell large, spire a little elevated, lips very broadly reflected, completely concealing the narrow umbilicus. The type measures 51 mm. in breadth and 43 mm. in height.

GOLDIELIX PRESTONI Gude, 1902.

1902. *Chloritis* (*Sulcobasis*) *prestoni* Gude, Journ. Malac., Vol. ix., p. 59, fig. 4 in text, June 30. Collingwood Bay, Papua.

GOLDIELIX MAJOR Smith, 1905.

1905. *Chloritis* (*Sulcobasis*) *globosa* var. *major* Smith, Ann. Mag. Nat. Hist., Ser. 7, Vol. xvi., p. 194, August. Owgarra, An(g)abunga River, Owen Stanley Range, 8,000 ft., Papua.

Specimens so named from Preston seem to belong to *Aleatelix* ante, so there is some confusion here.

GOLDIELIX GLOBOSA Preston, 1902.

1902. *Chloritis* (*Sulcobasis*) *globosa* Preston, Proc. Mal. Soc. (Lond.), Vol. v., p. 17, fig. 4, in text, April 23. Northern coast of Papua.

Genus DORCASIDEA *nov.*

Type, *Helix subplicifera* Smith.

Apparently a hairless species recalling *argillacea*, a Chloritoid form, but sculptured with radial lines, although preserving a punctate apex. Shell small, rather helicoid, spire a little elevated, umbilicus narrow, mouth open, lip a little expanded, columella reflected.

DORCASIDEA SUBPLICIFERA Smith, 1895.

1895. *Helix* (*Dorcasia*) *subplicifera* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 232, March. Northern coast of Papua. Figd. Smith, ib., Vol. xvi., p. 363, pl. 20, fig. 12, November, 1895.

Genus NANNOCHLORITIS Iredale, 1938.

1938. *Nannochloritis* Iredale, Austr. Zool., Vol. ix., p. 94, November 30. Orthotype, *Chloritis layardi* Gude.

NANNOCHLORITIS CHLORITOIDES Pilsbry, 1891.

1891. *Helix chloritoides* Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vi., p.

267, pl. 58, figs. 34-36 (shell, 12 x 10 x 6½ mm.), May 1. New Guinea (Denton) = Port Moresby.

The radular formula of this species is given as 127 x 24.11.1.11.24.

Note: While examining the Chloritids so-called to determine the relationships of the Papuan groups, a number of large shells was found to be included, mostly very unlike the true *Chloritis*.

In order to ensure more accuracy in comparison some of these are here named generically. When anatomical research, to the standard of Burrington Baker's work on the Pacific Zonitids, is undertaken probably every species will become at least a subgenus.

Genus QUIROSENA nov. Type, *Helix bougainvillei* Pfeiffer (Proc. Zool. Soc. (Lond.), 1860, p. 133, Moll., pl. 150, fig. 7, April. Solomon Group). This is a large solid flattened helicoid, imperforate shell, with a malleated upper surface, mouth open, subcircular, lips reflected.

Genus SHEBA nov. Type, *Helix hombroni* Pfeiffer (Proc. Zool. Soc. (Lond.), 1856, p. 382. Solomon Group). A strongly setose shell with a short very conical spire, last whorl strongly swollen, mouth crescentic, oblique, narrow, umbilicus small, concealed by columellar expansion, outer lip slightly reflected, roughly parallel to curve of body whorl, apex smooth. Said to have radular (50.1.50) and jaw features of *Eustomopsis*, with the genital organs resembling those of *Austrochloritis*, whose shells are very unlike the shell of the present genus.

Genus OPTERIGONE nov. Type, *Helix majuscula* Pfeiffer (Proc. Zool. Soc. (Lond.), 1856, p. 381. New Hanover). This shell is large, subdiscoidal, many-whorled, spire plane, lower surface sloping to a small deep perspective umbilicus, small oblique mouth, lip little expanded, columella vertical.

Genus TIMASENUS nov. Type, *T. penthilus* nom. nov. for *Helix rubra* Albers (Malak. Blatt., 1857, p. 93, pl. 2, fig. 13; Aru Is. ? = Mysol, fide Boettger, Proc. Mal. Soc. (Lond.), Vol. xi., p. 181, et seq., pls. iv. and v., September, 1914; not *Helix rubra* Nardo, 1847 (Sherborn). A large solid Helicoid with rounded whorls, smooth apex, narrow umbilicus, large oblique oval mouth "with a pearly luster inside", lip little expanded.

Family PLANISPIRIDAE.

The molluscs included in this family seem to merge with some of the small shells referred to the preceding family, so that reconsideration seems indicated. The radular features of the true *Planispira* are unlike those of the true *Chloritis*, while the general aspect of the former is also somewhat characteristic.

Genus CRISTIGIBBA Tapparone-Canefri, 1883.

1883. *Cristigibba* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 161 (dated July 5). Orthotype, *Helix tortilabia* Lesson.

CRISTIGIBBA MUSGRAVEI Smith, 1895.

1895. *Helix* (*Cristigibba*) *musgravei* Smith, Ann. Mag. Nat. Hist., Ser. 6, Vol. xv., p. 233, March. Back of Cloudy Bay, southern Papua. Figd. id. ib., Vol. xvi., p. 363, pl. 20, figs. 13-15, November, 1895, and Kobelt, Syst. Conch. Cab., Bd. I., Abth. xii., p. 829, pl. 224, figs. 13-14 (dated April 26), 1897.

CRISTIGIBBA FULGIDA *sp. nov.*

(Plate iv., fig. 19.)

A shell from Dinawa, inland from Hall Sound, recalls *musgravei*, but is much larger, spire a little more elevated, glossy, cream colour, with a thick red-brown anteperipheral band, mouth a little larger, pink lips, umbilicus

narrower and crest more pronounced. The type measures 22.5 mm. in breadth by 11 mm. in height.

Genus SPATIOLABIA *nov.*

Type, *Cristigibba macgregori* Hedley.

Tapparone-Canefri introduced *Cristigibba* for species of *Planispira* with a produced gibbous crest behind the aperture; in addition the spire was depressed, not elevated, the mouth small and subcircular instead of elongately broad, while the columella was plain and not basally toothed as in *Planispira*. Hedley placed all the Papuan species under *Cristigibba* as there was nothing like true *Planispira* in Papua. But most of the Papuan forms are as unlike *Cristigibba*, as they have the crest reduced or obsolete, while the mouth has largened and developed a broadly expanded outer lip, and the name *Spatiolabia* is introduced for these, *macgregori* being selected as type. Radular formula, 110 x 26.20.1.20.26.

SPATIOLABIA MACGREGORI Hedley, 1891.

1891. *Cristigibba macgregori* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 82, pl. x., figs. 17-19, September 9. Aipiana, St. Joseph River, Papua.

SPATIOLABIA DEANIANA Ford, 1890.

1890. *Helix* (*Planispira*) *deaniana* Ford, Proc. Acad. Nat. Sci. Philad., 1890, p. 188, July 29. New Guinea (Denton) = Port Moresby district. Figd. (type), Pilsbry, Man. Conch. (Tryon), Ser. 2, Vol. vi., p. 292, pl. 63, figs. 56-58, May 1, 1891.

SPATIOLABIA MACKAYI *sp. nov.*

(Plate iv., fig. 20.)

S. macgregori is represented in the Purari Valley by a species with a narrower umbilicus, the flaring lips even more developed, especially towards the spire, while towards the base a pronounced angular crest appears behind the aperture. The type measures 30 mm. in breadth and 15 mm. in height.

SPATIOLABIA RHODOMPHALA Tapparone-Canefri, 1883.

1883. *Helix rhodomphala* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 176, pl. 4, figs. 12-13 (dated 5/6 July). Fly River, Papua.

SPATIOLABIA DOMINULA Tapparone-Canefri, 1883.

1883. *Helix dominula* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 178, pl. 4, figs. 8-11, pl. 7, fig. 4, pl. 9, figs. 5, 14 (dated July 5/6). Fly and Katow Rivers, Papua.

These two species appear to be represented in the Purari Valley and Douglas River by others differing slightly as follows.

SPATIOLABIA DULCIOR *sp. nov.*

(Plate iv., fig. 21.)

This species recalls *rhodomphala* but has a wider umbilicus, the mouth is less oblique and the crest weaker, smaller in size but with the same coloration, the lip pale pinkish rose, the colour bands dark red-brown. The type measures 17 mm. in breadth and 8 mm. in height, from the Purari Valley.

SPATIOLABIA PERMIXTA *sp. nov.*

(Plate iv., fig. 22.)

Differing from *dominula* in the flatter spire, colour bands, wider umbilicus, and also from *macgregori* in the same features, while it is larger than the preceding *dulcior*, and has the flaring lip of *macgregori*. The type

measures 23 mm. in breadth, and 10.5 mm. in height, from the Douglas River, collected by T. Bevan.

Genus SETOGIBBA *nov.*

Type, *Helix plagiocheila* Tapparone-Canefri.

This genus is a relation of *Cristigibba,* which has developed a pilose periostracum. The shell is small, spire planate, apex concave, umbilicus narrow open, mouth oblique, subcircular, outer lip reflected all round and succeeded by a weak gibbous crest, the base of the last whorl towards the aperture also swollen.

SETOGIBBA PLAGIOCHEILA Tapparone-Canefri, 1883.

1883. *Helix plagiocheila* Tapparone-Canefri, Ann. Mus. Civ. Genova, Vol. xix., p. 174, pl. 5, figs. 4-7, pl. 7, fig. 6 (dated July 5). Fly and Katow Rivers, Papua.

SETOGIBBA ENIGMA *sp. nov.*

From the Purari Valley comes a similar shell with the mouth more contracted, the lip reflection less pronounced, the basal swelling obsolete, the umbilicus much wider, the shell measuring 15 mm. in breadth and 7 mm. in height. It is even possible that this species is not congeneric, and as the mouth is somewhat sinuate basally, a new subgeneric name is proposed, *Qualigibba,* for it alone.

Note: While investigating this group, the hair producing faculty and gibbous crest behind the aperture appear in both *"Planispira"* and *"Chloritis",* so that in collections some superficial *"Planispira"* are called *"Chloritis",* and vice versa, and the phenomena invite study. On the other hand, the species of *"Planispira"* called *scheepmakeri* Pfeiffer, has developed a very strong peripheral keel, the upper surface convex, the base concavely flattened, with the mouth attenuated to a beak, recalling that of *Rhynchotrochus,* the edge of the lip expanded, and the columella scarcely reflected. This deserves a generic name *Phrenegibba* nov. On the opposite end of the chain appears *loxotropis* Pfeiffer, which is even more curious as it is lustreless, being rather strongly striate, and the spire not plane, but elevated, sometimes conical, a peripheral keel present, the mouth elongate, the lips little reflected but with a gibbous crest behind, while the narrow umbilicus is half choked by the columella. For this quaint development the new generic name *Minacispira* is introduced.

Before leaving this group it may be pointed out that once a Papuan species was referred to *corniculum* Hombron & Jacquinot. The reference is to the Voy. Pôle Sud. Atlas, pl. v., figs. 10-13, which appeared as far as is known in 1853. But in the New Zealand List there is a *corniculum* Reeve, 1852, the type of the genus *Mocella.* Reference to Reeve found that he had described the Neozelanic *corniculum* (Conch. Icon., Vol. vii., sp. 826, pl. 133, dated October, 1851, in error = October, 1852, referring to Pfeiffer's name *"eta"* in the Proc. Zool. Soc. Lond., 1851, where it does not occur), but that previously he had introduced the New Guinea *"Planispira"* as *Helix corniculum* Pfeiffer, without locality (pl. 92, sp. 502, dated April, 1852). Therefore the New Guinea shell must be known as *"Planispira" corniculum* Reeve, 1852, while the New Zealand shell must be re-named as MOCELLA COGITATA *nov.*

Genus MAGITRACHIA *nov.*

Type, *Planispira blackiana* Preston.

Recalling *Torresitrachia* in general appearance, but the mouth is seen to be more circular, whorls less rounded, subangulate above, with the

umbilicus more cavernous, the sides steeper, sutures deeply impressed, sculpture of fine radials developing into distant radials, almost ridged towards the aperture. The protoconch is minutely pustulose, whereas *Torresitrachia* has the protoconch smooth but with obscure radials suturad.

MAGITRACHIA BLACKIANA Preston, 1905.

1905. *Planispira* (*Trachiopsis*) *blackiana* Preston, Proc. Mal. Soc. (Lond.), Vol. vi., p. 207, fig. in text, March 17. Port Moresby district, British New Guinea (Black).

[Family HELICOSTYLIDAE.

Through Hedley describing a shell ascribed to this group some place has to be given it, but as it has not been recovered since there seems doubt as to the correctness of the locality.

"COCHLOSTYLA PAPUENSIS Hedley, 1891."

1891. *Cochlostyla papuensis* Hedley, Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 96, pl. xii., fig. 30, September 9. British New Guinea (Goldie).

As Andrew Goldie was also a storekeeper, it is possible that this is an extralimital shell, as no locality is exactly given, and no member of the family normally inhabits New Guinea.]

Superfamily PARYPHANTOIDEA.

The reference by Hedley, Smith, Fulton & Möllendorff of shells to the genera *Rhytida* and *Paryphanta* suggests they may belong to this superfamily, but even this is doubtful.

Genus GALLODEMA *nov.*

Type, *Rhytida globosa* Hedley.

Obviously this Alpine mollusc has nothing to do with the Neozelanic *Rhytida*, the depressed globose form, coloration, sculpture, narrow umbilicus, and pitted apical whorls dissevering it rather widely, and it is only left in this location through the selection of the generic name, and it may be an aberrant Zonitid.

GALLODEMA GLOBOSA Hedley, 1890.

1890. *Rhytida globosa* Hedley, Ann. Rep. New Guinea, 1888-89, p. 65; Nature, December, 1890, p. 115; Proc. Linn. Soc. N.S.W., Ser. 2, Vol. vi., p. 80, pl. x., figs. 15-16,, September, 1891. Mt. Victoria, Owen Stanley Range, Papua, 13,000 ft.

GALLODEMA TROBRIANDENSIS Smith, 1897.

1897. *Rhytida trobriandensis* Smith, Proc. Mal. Soc. (Lond.), Vol. ii., p. 287, pl. xvii., figs. 1-3, November. Trobriand Is.

GALLODEMA PAPUENSIS Preston, 1902.

1902. *Macrochlamys papuensis* Preston, Proc. Mal. Soc. (Lond.), Vol. v., p. 17, fig. 1 in text, April 23. Northern Coast of British New Guinea.

Genus ILLONESTA *nov.*

Type, *Paryphanta louisiadarum* Möllendorff.

Whatever the location of this shell may be, it cannot remain in *Paryphanta*, based on the large New Zealand shell, with which this appears to have nothing in common. *P. busbyi* measures 60-70 mm. in breadth, while the present species reaches 10 mm., and an entirely different form, a large oblique mouth and imperforate thin shell contrasting with the comparatively small mouth and wide umbilicus. Really the form recalls *Helicarion* much more than *Paryphanta*.

ILLONESTA LOUISIADARUM Möllendorff, 1899.

1899. *Paryphanta louisiadarum* Möllendorff, Nachr. d. malak. Gesell., 31st Year, p. 89, May-June No. Louisiade Group. Figd. Syst. Conch. Cab., Bd. I., Abth., xii.B., p. 7, pl. 3, figs. 1-3, dated 13.xi.1902.

ILLONESTA STRIATA Fulton, 1902.

1902. *Paryphanta striata* Fulton, Ann. Mag. Nat. Hist., Ser. 7, Vol. ix., p 182, March. River Arva (= Aroa), Papua (Emil Weiske).

ILLONESTA ELEGANS Fulton, 1902.

1902. *Paryphanta elegans* Fulton, Ann. Mag. Nat. Hist., Ser. 7, Vol. ix., p. 182, March. River Arva (= Aroa), Papua (Emil Weiske).

SLUGS.

Although there may a large slug fauna this is entirely unknown, the only record being one of *Atopos prismatica* Tapparone-Canefri, a Sorong species, from the Fly River.

EXPLANATION OF PLATE III.

Fig. 1. *Xesta oldhamiana* Iredale.
„ 2. *Xesta interjecta* Iredale.
„ 3. *Amenixesta fifensis* Iredale.
„ 4. *Xesta cornecerea* Iredale.
„ 5. *Xesta dinawa nubilisinus* Iredale.
„ 6. *Zagmena jansoni* Smith.
„ 7. *Xesta dinawa* Iredale.
„ 8. *Necvidena froggatti* Iredale.
„ 9. *Xesta complicata* Iredale.
„ 10. *Amenixesta mita* Iredale.
„ 11. *Canefriula cynthia* Fulton.
„ 12. *Rosselidena cornea* Hedley.
„ 13. *Canefriula rolandi* Iredale.
„ 14. *Letitia subglobosa* Fulton.
„ 15. *Canefriula cingulata* Hedley.
„ 16. *Canefriula sicula* Brazier.
„ 17. *Claudettea bevani* Hedley.
„ 18. *Kendallena qualis* Iredale.
„ 19. *Goldielix mita* Iredale.
„ 20. *Goldielix meraca* Iredale.
„ 21. *Goldielix neptis* Iredale.
„ 22. *Braziera aignanensis* Hedley.

EXPLANATION OF PLATE IV.

Fig. 1. *Rhynchotrochus taylorianus* Adams & Reeve.
„ 2. *Rhynchotrochus monticola* Iredale.
„ 3. *Rhynchotrochus praefectus* Iredale.
„ 4. *Rhynchotrochus sinucola* Iredale.
„ 5. *Rhynchotrochus vallicola* Iredale.
„ 6. *Rhynchotrochus extraneus* Iredale.
„ 7. *Rhynchotrochus mysticus* Iredale.
„ 8. *Letitia adjuncta* Iredale.
„ 9. *Letitia interrupta* Iredale.
„ 10. *Letitia moturina* Iredale.
„ 11. *Letitia albolabris* Hedley.

„ 12. *Letitia maria* Iredale.
„ 13. *Letitia degener* Iredale.
„ 14. *Caroletitia vilia* Iredale.
„ 15. *Henga deliciosa* Iredale.
„ 16. *Violenga misima* Iredale.
„ 17. *Tepomusa confirma* Iredale.
„ 18. *Disteustoma nema* Iredale.
„ 19. *Cristigibba fulgida* Iredale.
„ 20. *Spatiolabia mackayi* Iredale.
„ 21. *Spatiolabia dulcior* Iredale.
„ 22. *Spatiolabia permixta* Iredale.
„ 23. *Setogibba enigma* Iredale.

A CONTRIBUTION TO THE BIOLOGY OF THE SATIN BOWER-BIRD.

By E. Nubling, Normanhurst.

(Plate v.)

During the period October, 1920, to June, 1921, I saw a good deal of the Satin Bower-bird (*Ptilonorhynchus violaceus* Vieill.), in National Park, New South Wales, and learned much of the habits of this interesting species. I recorded my observations in the July number of the "Emu" in the latter year.

Reading after many years again through these pages, it struck me that already then my attention had been aroused by the apparent preference shown by the adult male for certain colours in the articles which he selected for the decoration of his bower, principally blue, greenish-yellow, yellow-green, olive-green, and brown, and which seemed to constitute a kind of selective colour scheme. There should be some explanation of this phenomenon. Another question was the assertion that the bird was particularly attracted by any bright objects, which, however, my own observations so far had not borne out.

Thereafter, I devoted much time to fairly regular and systematic observation in the field right up to about the end of 1925, though more occasional field work was done for still another two years or so. Nothing, however, apart from a paper on bower painting ("Emu", July, 1939) has been published by me bearing on this extensive field work and its results. The present paper, then, is to make up for delayed action.

The bulk of the field observations was, as already indicated, made in National Park, a large protected area on the coast, south of Sydney, consisting mainly of uplands, divided by the Hacking River and its many tributary creeks. The uplands play practically no part in the Satin-bird's life, which for reasons of food supply is concentrated on the immediate neighbourhood of the river and a number of tributary creeks, more in particular in the upper river reaches. On some of these creeks the Satin-bird may be found for several miles up stream, also on some creeks, which empty direct into the ocean. The reason for this distribution of the bird is the occurrence of brush or rain-forest along river and creeks. As a rule the brush is of small lateral extent only, closely bordered by open forest and xerophytic scrub on the adjoining slopes, and often intruded by either of them. A stretch of rather typical brush-forest, some two miles long, is found on the west side of the river, roughly between the mouths of Bola Creek and Dumbal Creek.

From among the brush flora a few typical trees may be mentioned: three species of Figs (*Ficus rubiginosa, F. macrophylla, F. aspera*), the Turpentine (*Syncarpia laurifolia*), the Lillipillies (species of *Eugenia, Rhodamnia,* etc.), the Water Gum (*Tristania laurina*), Coachwood (*Ceratopetalum apetalum*), Sassafras (*Doryphora sassafras*), species of Pittosporum, the *Schizomeria ovata,* Bastard Rosewood (*Synoum glandulosum*), Black Apple (*Sideroxylon australe*), Blueberry-tree (*Elaeocarpus (cyaneus) reticulatus*), *Callicoma serratifolia,* Maiden's Blush (*Sloanea australis*), Giant Nettle-tree (*Laportea gigas*), the frequent Cabbage Palm (*Livistona australis*), and rather rare Bangalow Palm (*Archontophoenix Cunninghamii*), the elegant *Tieghemopanax Murrayi,* tall climber Vitis, and cane-like *Flagellaria indica;* finally, as an exception to the rule in this association, a gum tree, the Blackbutt (*Eucalyptus pilularis*). The fruits of a number of these trees are important as foods for the Satin-bird, especially the figs.

The adjoining xerophytic floral association and the open forest are mainly of interest in so far as they provide the Satin-bird with many of his decorative objects in the shape of flowers, leaves, etc.; also with a few fruits (berries) as food.

Since the twenties, when my observations were made in the Park, the brush forest unfortunately has been much reduced in places owing to road construction and other causes, with the consequence that Satin-birds, as well as Cat-birds, Parrots, Topknot Pigeons, and other birds which feed on native fruits are not now so plentiful as they were then.

Bowers, without exception, are always situated near water. They occur in sheltered spots all along the river, frequently at the mouth of side creeks and smaller rivulets, as well as along various creeks, sometimes at a considerable distance from their mouth. In various instances I have found bowers only a few inches or not more than a foot or so above river water level, so that any rising of river or creek would inevitably flood them. Yet they were built there again and again.

It may here be mentioned that up to the end of 1927 alone some 150 bowers gradually came under my observation in National Park. From the beginning in 1920 I kept records about anything of interest about known bowers, particularly the decorative objects found there. They were made regularly and meticulously on innumerable visits and included, of course, observations on the behaviour of the birds at the bower (and elsewhere), their play habits, and many other subjects, so that in time a mass of evidential material about all these things was accumulated, and could when required be drawn upon. Visits were made generally all the year round, and this custom has enabled me to gather much valuable information about the life and habits of the Satin-bird, which would have been unobtainable had I confined my study to the breeding season alone.

Before going into the colour question and decorative habits of the Satin-bird, I wish in the first instance to make reference to the following statement by that most observant and keen naturalist, John Gould (1848). He wrote in regard to the Satin-bird:—

> "The proceedings of these birds have not been sufficiently watched, to render it certain whether the runs (bowers) are frequented throughout the year or not, but it is highly probable that they are merely resorted to as a rendezvous or playing ground, at the pairing time and during the period of incubation."

Gould observed the Satin-bird, his bower, his habits, etc., in the cedar brushes of the Liverpool Range in October, and/or November, 1839, that is in the breeding season of the species. Now, in reading the above short paragraph, it will at once be observed that Gould carefully refrained from generalizing about what he had found in the breeding season. He did not say that bower building and bower attendance were confined to that season as part and parcel of courtship, etc., but only expressed the opinion that it was highly probably so, thus leaving it to future observers to clear up this point. Nearly three-quarters of a century had passed since Gould published the above lines, when I made my field investigations in the first half of the late twenties. I have searched the literature for any clue indicating that activity of the Satin-bird at his bower was not confined to the breeding season, but completely failed to find any such reference. To the contrary, only a few years ago, I read statements to the effect that activity at bowers did not extend beyond December.

My own experience and observations, on the other hand, have early satisfied me that attendance of, and play at, the bower, as well as the erection of new bowers, are not, as Gould tentatively assumed, exclusive features of the pairing and incubating period, but that, depending on and varying with the locality, they can be observed all the year round, in National Park at least, as will presently be shown. The factor by which such proceedings are largely governed is the food question.

The food available is, no doubt, the reason why the birds are present at any one particular time in any one particular locality. When it is exhausted they will depart. There would be nothing strange in that, since birds in general are cognisant where and when to find their food at different times of the year. What I wish to emphasize is that Satin-birds are not only present in National Park in the off-time of the year, i.e., after the normal close of the breeding season at the end of December, and, say, up to the end of August, in every one of these eight months, but that in that period they have been found to use, and play at such bowers which have persisted from the previous year, or, where the bower had disappeared, to play in trees on the former bower site in numbers. But, most important, that they have erected and decorated, and on various occasions been seen playing (performing) at newly-erected bowers.

The following record—I have selected at random the years 1923 and 1924—will show this. Only newly-erected bowers are considered.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug
1923—New bowers erected	3	1	2	1	10	2	3	5
1924— „ „ „	4	3	1	2	2	2	2	1

No hard and fast rule can, however, be established in this respect, as ecological conditions no doubt vary from year to year, not only in general, but in the same locality. Thus certain fruits may be plentiful in one year, but only normal, or sub-normal in the next. In May, 1923, conditions must have been very favourable and food supply plentiful in a number of places, as the large number of new bowers would seem to indicate, while in the following year the conditions were reversed.

Thus in some localities, e.g., at Burunda Creek, from 1922 to 1924, new bowers after the interval were seen respectively on the 25th June, 13th May and 27th April; at Waterfall Creek, above the falls, from 1921 to 1923 respectively, on the 10th July, 25th June, and 6th May. At Bola Creek the interval seemed to be much extended, in one locality, there at least, and new bowers were not noted there before September or October.

Of the position at Tamur Creek, one of my principal observation points during the first five years, I will give a special account in regard to the year 1922, in which this locality was visited on 35 occasions. On the 8th January bower No. 12 of the previous year was still standing, but deserted; a fortnight later it was found levelled to the ground, no sign of any birds. This state continued right up to the 21st May. On that day the blue male, last year's bower owner, was seen again for the first time in five months, and a fortnight later, on the 4th June, there was a new bower, decorated with a dozen greenish-yellow flowers of *Billardiera scandens*, and a solitary brown snail shell. About ten feet away in the bracken there was a new platform of sticks without decorations, and, still further away, an ancient little playground, on which now were seen eight small upright sticks in a line rammed into the ground. I had not seen such a thing before, and

wondered whether it might be the beginning of a bower, but nothing eventuated later on. The blue male was seen about the bower, which, much enlarged and perfected in time, remained, as was noted on many consecutive visits, in uninterrupted use right up to the 31st December, on which day it was destroyed by a bush-fire. A second bird, a green one, was present, too, but kept to the trees. I feel certain it was a female.

The return of the blue male late in May seemed to be for the purpose of establishing his territorial rights, demonstrated by the erection of a bower shortly afterwards.

In the period 4th June to 1st October, I saw relatively little of the blue male, but his bower was always decorated with fresh flowers, etc., showing his presence and attendance. There was only one exception, the 13th August, when the bower was without flowers, and its appearance indicated that it was then not in use. No green birds were noted in the locality in this period.

On the 1st of October there was great activity at the bower, which was well decorated, mostly with flowers, and much performing by the male was going on. A female was present for the first time, taking up her position in the bower during the proceedings. On the following day, the 2nd October, I was at the bower for six hours up to 6.15 p.m. The blue male was seen performing there at various times, or otherwise busying himself in and about the bower, once chasing away an intruding blue bird, but the female was not seen at all until shortly after 6 p.m., when, after a call of her by the male from the top of a high gum tree, she appeared on the scene to join him at the bower. Both appeared somewhat excited. There was no performance at the bower, but presently both dived in the surrounding scrub, where glimpses of them could be caught every now and then, the male evidently chasing her. Finally they dropped out of sight behind a large log. When they emerged again from there after a short while, the female was seen departing at once, flying up river, while he returned to the bower, with no particular aim seemingly. Apparently copulation had taken place behind the log. I had to leave then.

Green birds after that were noted in the locality on various occasions, but it was not until the 17th December that I saw the female again at the bower together with the male. This is, however, no criterion that she was not there at other times, as in my experience the female usually visits the bower in the early morning, up to about 9 a.m., to take her part in the male's performances, while during the rest of the day she is hardly ever seen there, except perhaps again in the late afternoon.

In the following year, 1923, the new bower at Tamur Creek, after the interval, was noted as early as the 6th May, in 1924 on the 11th May.

At Kangaroo Creek, owing to the proximity of the rest-house there, conditions in the off-time were quite different in 1923, and the Satin-birds might be seen feeding in the fowl-yards with the fowls. In a rather small circumscribed area on a creek flat new bowers, including a double one, were noted on the 24th February, 29th April, 13th May, 2 new ones on the 29th July, again two new ones on the 11th August, one new one on the 8th September. Some of these were green birds' bowers. Some performing was usually going on at these bowers. On the 11th August a rather extraordinary sight was presented there, for on that day no less than 5 bowers were seen to be attended simultaneously by the birds, while there was a sixth in addition, which, however, though intact, was out of use.

I think the foregoing examples are sufficient to show that the off-time of the year, in National Park at any rate, is not a dead time for the Satin-birds. Numerous other instances could be given.

Colour Vision, Colour Sense, and Decorative Habits.

We may now turn to the colour problem. I shall begin with an examination of the literature on the decorative habits of the Satin-bird up to the time when I had come to form some definite conclusions about the results of my own investigations on this subject. This with a view to ascertain whether any clues or indications may be found in this literature pointing to a discriminative colour sense in this species. The quotations submitted will be accompanied by critical and other remarks. Only quotations referring directly to colour or brightness of decorative objects will be considered in this first part.

John Gould (1848), the first to give a scientific account of the decorative and other habits of the Satin-bird, wrote:—

> "The interest of this curious bower is much enhanced by the manner in which it is decorated at and near the entrance with the most gaily-coloured articles that can be collected, such as the blue tail feathers of the Rosehill and Pennantian Parrots, bleached bones, the shells of snails, etc., some of the feathers are stuck in among the twigs, while others with the bones and shells are strewn about near the entrance."

He also found "some slips of blue cotton rags, which the bird had doubtless picked up at a deserted encampment of the natives". There is no mention of flowers. Here may be noted the first reference to the colour blue.

George Bennett (1860) quotes Gould's description without adding any new feature.

Charles Darwin (1871) refers to Gould and says:—

> "The playing passages of bower-birds are tastefully ornamented with gaily coloured objects, and this shows that they must receive some kind of pleasure from the sight of such things."

In another place, in regard to the three allied genera of Australian Bower-birds then known, *Ptilonorhynchus, Chlamydera,* and *Sericulus,* he writes:—

> "The bowers (Fig. 46 is that of *Chlamydera maculata*) . . . are decorated with feathers, shells, bones, and leaves, are built on the ground for the sole purpose of courtship." . . .

Finally, this time with direct reference to the Satin-bird:—

> "The Satin Bower-bird collects gaily-coloured articles, such as the blue tail-feathers of Parrakeets, bleached bones and shells, which it sticks between the twigs or arranges at the entrance."

The lumping together of the three genera of Bower-birds in regard to their decorative objects was, I think, not a very good choice and has no doubt led to much confusion, misunderstanding, and obscuration of the subject later on. I do not, however, intend to go into any further details. I may say, however, that Darwin does not quote Gould correctly when he says that the decorative objects are stuck by the Satin-bird between the twigs or are arranged at the entrance, for Gould says distinctly that only some of the feathers are stuck between the twigs (of the bower walls),

while other feathers and the rest of the decorations are shown about near the entrance. In my own experience, as well as that of other field workers, the principal place for the deposition of the Satin-bird's treasures is, in confirmation of Gould, the platform outside the bower structure proper. Decoration of the bower walls is not a general feature at all in National Park; it is rather exceptional and individual. Thus in one locality I have during many years regularly found in the bower there one or a few decorations on the floor of the passage through the bower, and in one instance a piece of blue or purple raffia worked into one of the walls, but the bulk of the decorations there was always placed on the platform outside. Indeed, some birds will not tolerate any object inside the bower, and if one is placed there, even if it is an otherwise acceptable decoration, will, immediately it is spotted, be removed to the platform, or else thrown out altogether.

Newton (1896) says that "the 'run' of the Satin-bird . . . [is] decorated with the highly-coloured feathers of the Parrot-tribe", so that we may assume red, orange, yellow, green, blue, etc., feathers. Such an unqualified statement—Gould speaks of blue feathers only—obscures the colour problem.

Rothschild (1898) writes in a similar strain, and says that the bird builds:—

> "grosse, mit bunten Federn, Muscheln, and anderen bunten Gegenstaenden ausgeschmueckte Lauben."

(We find here again bright-coloured feathers and other bright objects.) As to the "Muscheln", this word is in German only applied to sea-shells and mussels; snail shells are never given that name, but are called snail-houses.

Pycraft (1910) remarks of the Satin-bird's bower: "That the entrance to this is decorated with snail shells, bleached bones, and bright feathers". In a later work (1914) he varies this to "a miscellaneous assortment of highly coloured feathers, bleached bones, and occasionally flowers". No specific colours are stated, but for once at least the bones and snail shells are not called bright objects.

Saville Kent, in "A Naturalist in Australia", speaks of "gaudy parrot feathers" being collected by the Satin-bird.

Frank Finn, in "Birds as Bower-builders" ("Marvels of the Universe") expresses the opinion that "this species decorates its bower, but uses anything it can get hold of, such as pebbles, shells, bones and feathers. Other Bower-birds specialize more in their decorations".

Similarly, H. Knight Horsfield, in "Side Lights on Birds", find that the decorations assembled by our birds are collected "without much discrimination", and one feels tempted to add, just as the author collected his information. As to the indiscriminate collection of his decorations by the Satin-bird, one can only remark that these statements are not supported by facts, as will be seen later.

In "The Story of the Bower-bird" (in "Natural History"), by Prof. J. A. Thomson, one reads about the Satin-bird's bower:—

"This arch or arbour may be several yards long [sic!]. . . . It is often festooned with creepers. But there is something more, for in front of the entrance there is a beauty feast, namely, a miscellaneous collection of snail shells, bleached bones, bright feathers, and so forth."

Not one of the above statements, and they might be augmented, produces anything helpful in elucidating the colour problem here concerned.

i.e., where colour, specific colour, is the principal factor. Instead, we constantly and persistently hear the terms bright, bright-coloured, highly-coloured, gaily-coloured, gaudy, etc., which quite obscure the question at issue. For the emphasis is laid on the brightness of the object collected by the Satin-bird, colour being of interest only as long as it is bright, luminous, shining. The only definite colour stated is the blue in tail-feathers of the Rosehill and Pennant's Parrots, and that is accompanied by the adjective "gaily-coloured".

Well, let us have a look at the gaily- or brightly-coloured decorations. There are first the bones, or bleached bones, which are ever recurring among the principal decorative objects. Personally, I have come across bones at bowers not more than twice in many years, and then only single old, dirty ones, never any number. But I wouldn't have enough imagination to call them gay. Quite possibly they were only accidentally on the platform. Pebbles I have never seen at a bower, though the bird, if he wanted them, could have easily got them at the river, which is close to many bowers. Snail shells in a few shades of brown, on the other hand, i.e., when fresh, are very frequent decorations at bowers, but I can't see anything bright or gay in them, and less so when they are bleached.

Gould (1848) draws attention to "the propensity of these birds to pick up and fly off with any attractive object", and he gives as an instance "the bowl of a pipe". Now, I wish to state quite definitely here that form is of no attraction to the Satin-bird. If, however, as is most likely, this bowl happened to be brown, the matter would be in order, since the bird does collect brown-coloured objects.

None of the decorations mentioned by the various authors as collected on account of their brightness offers any encouragement to accept that view. Indeed, the brightness factor is not only a very doubtful one, but does not operate at all. The question will, however, a little further on be gone into, viewed from another angle. But before that we shall see what some Australian authorities have to say on our subject.

A. J. Campbell (1901) writes that "at a bower seen at Christmas in Gippsland, Victoria", the chief decorations were the gay feathers of the Crimson Parrot (*Platycercus elegans*), "no doubt the usually seen blue-violet wing- and tail feathers". He also writes:—

"Mr. J. W. De Lany only noticed blue feathers at bowers. His wife, by way of experiment put out several pieces of coloured wool near the house: only the blue ones were taken to the bower."

Here, for the first time to my knowledge, attention is drawn to the preference of the Satin-bird for a distinct colour, blue, without any reference to its brightness. Campbell also mentions a Mr. Lau, of South Queensland, as giving, in 1887, the following decorations seen by him at bowers, namely: "moss, flowers, yellow and blue Lory Parrot feathers, small bones and snail houses", nothing being said of brightness. As to the moss, the only so-called moss I have not infrequently found at bowers in certain localities in National Park, and always in a dry state, is the clubmoss *Lycopodium densum*, which is, however, not a true moss at all, but a pteridophyte.

I may here mention that I obtained my first information about the Satin-bird from Campbell's "Nests and Eggs" when living in Victoria.

A. J. North (1901) gives the following account of bower decorations of our birds:—

". . . bits of bleached bones, land shells, pieces of moss, berries and bright feathers, one or more of the latter . . .; chiefly of Pennant's and the Rosehill Parrakeets, being worked into the sides [walls] of the bower. Since the advent of settlers in Australia any bright or glistening article is used by the birds to ornament their playgrounds." Here we find again plainly indicated that the Satin-bird is principally concerned with brightness without discrimination of colour. A bower seen by North in South Gippsland, Victoria, was "with the exception of a few land shells entirely decorated by bits of broken crockery and glass", colour not mentioned. Another bower seen in the Kempsey district of New South Wales "had the cast skin of a small snake worked into the front of one of the walls, and was ornamented with a few bits of green moss, dead leaves, and dried sprigs of flowers."

Sid W. Jackson (1907) is, and rightly, intrigued about the Satin-bird's fondness for blue. He writes:—

"It would be interesting to learn why these birds have the strange habit of decorating the bower with blue feathers and pieces of blue glass, in preference to other colours. Their eyes, being a beautiful blue, may have something to do with it." Well, we shall have something to say about that in due course.

A good description of decorations at bowers in the scrubs of the Macpherson Range of southern Queensland by the same field observer (1920) may here also be inserted:—

"Several of their bowers or playgrounds were met with. They were highly decorated with 5-petal blue flowers from a shrub known as Kangaroo Apple (*Solanum aviculare*), which were very common in damp gullies in the scrub . . .; many dead scrub snail-shells of several species were frequently used as decorations."

In one bower five species of *Helix*, also *Panda falconeri*, were found, and pieces of cast snakeskin, blue flowers, empty cicada cases, fungi, seeds, parrots' blue feathers, etc., as will be seen all natural objects. Pieces of blue cardboard scattered about in the scrub by Jackson, or placed on logs some distance away, were nearly all picked up by the bird and taken to the bower. All this in agreement with my own experiences.

Finally, I would mention H. V. Edwards, Bega (1920), who in a short article uses for the first time the term colour sense. He also lays stress on the Satin-bird's decided preference for the colour blue (inclusive of "purple blue"), while he, on the other hand, thought a few yellowish-green flower petals, snail shells, cocoons, and a bit of snakeskin found at bowers, were of no significance. In this he made a mistake. He made, however, the pertinent observation that, although "red, yellow and white flowers were available, the bird passed them by".

It is, however, Prof. J. Arthur Thomson (1923), who strikes at the root of the colour problem with the following suggestive and stimulating words:—

"Little seems to be known in regard to the colour sense of birds." Yet:—

"The use of brightly coloured pods and flowers by Bower-birds suggests a colour sense . . . but it is always difficult to distinguish what may be discrimination of colour from what may be only discrimination of differences in the intensity of the light reflected from the surface."

The problem may then be formulated thus: Does the Satin-bird in the choice of the decorations used by him discriminate between different colours

and select those which are agreeable to his special taste, or does he select his decorative objects solely with regard to their luminosity or brightness irrespective of colour?

I think the difficulty of Prof. Thomson is not unsurmountable. For there can in my opinion be very little doubt that the male Satin-bird is not concerned with the assembly at his bower of bright objects as such.

But to be better able to support this assertion with some more special and definite data, I will give first a list of the various decorative objects which I have observed, and taken records of at bowers of Satin-birds in the National Park area, offering some positive specialised evidence in regard to the colour problem, and also that of colour versus brightness.

Flowers (a) blue to spectrum violet, and violet purples: *Comesperma ericinum, C. volubile, Conospermum tenuifolium, Dampiera stricta, Dianella caerulea, D. revoluta, Hardenbergia monophylla, Hovea linearis, Ionidium filiforme, Lobelia gibbosa, Patersonia sericea, Philoteca australis, Prostanthera violacea, Ruellia australis, Scaevola ramosissima, Solanum aviculare, Stypandra caespitosa, Thelymitra ixiodes, Viola betonicaefolia, V. hederacea, Wahlenbergia gracilis,* and the extra-Australian *Jacaranda mimosaefolia*; also cultivated flowers, accepted in tests: *Bougainvillea* spp., *Cineraria* spp., *Delphinium Ajacis, Matthiola* spp. (Stocks), and species of *Pelargonium, Plumbago, Portulaca*; (b) yellow-green: *Billardiera cymosa, B. scandens;* delicate green: *Chloanthes glandulosa*; (c) creamy and lemon yellow: *Acacia binervata, A. decurrens, A. discolor, A. floribunda, A. juniperina, A. longifolia, A. oxycedus, A. suaveolens,* etc., usually small sprigs of these; *Dendrobium speciosum, Helichrysum lucidum* (faded).

The flowers and some collected fruits (e.g., berries of *Elaeocarpus cyaneus*) belong to 25 families and 35 genera of plants.

Leaves (always dry): *Banksia aemula, B. integrifolia, B. latifolia, B. serrata, Schizomeria ovata;* the leaves of these two genera are the principally collected leaves; occasionally found *Loranthus* spp., *Polyosma Cunninghami, Trochocarpa laurina;* both leaves and dry pseudobulbs of the orchid *Dendrobium tetragonum.*

Other Vegetative Objects: Young curled fern fronds; the (dry) club moss *Lycopodium denum*; fruits of *Billardiera scandens* and *Solanum aviculare;* pods of Acacias; blue berries of *Dianella caerulea,* etc.; grass seed husks; puff ball fungi; small brown toad stools.

Snail shells (brown): *Rhytida capillacea, Thersites jervisensis,* and other species.

Feathers of: Crimson Parrot (*Platycercus elegans*) Turquoise Parrot, (*Neophema pulchella*), White Cockatoo (*Cacatua galerita*), Lyre-bird (*Menura superba*), Satin-bird, Masked Owl (*Tyto novaehollandiae*), Boobook Owl (*Ninox boobook*), Tawny Frogmouth (*Podargus strigoides*), and others.

Varia: Empty Cicada cases; case of Hawk Moth (*Sphingidae*); egg bag of Mantis; paper nest of Wasp; light green dead beetle; pieces of cast skin of Snake and Lizard; pieces of onion and onion skin, etc.

Artificial Objects: A few of the most frequent may be quoted, mostly of blue, violet, or purple colour; bits of paper, cardboard, paper wrappers; matchbox drawers, or parts thereof; threads, ribbons, pieces of fabric of cotton, wool, silk, etc.; pieces of broken china and glass, enamel, bakelite-

ware; bags of washing blue; a blue glass heart from a brooch, and many other things.

The description of the decorations of a most representative bower found by me may follow: 9/9/1923.—Bower "OO", Upper Peach Trees, west side of the river. Deposited on platform; about 10 yellow-green flowers of *Billardiera scandens;* about a dozen chalcedony-yellow flowers of *Dendrobium speciosum,* a blue-violet flower of *Thelymitra ixioides,* several blue-violet ones of *Lobelia gibbosa,* a number of dry leaves of *Banksia serrata,* eight wisps of grass seed husks, two blue-violet feathers of the Crimson Parrot, a few each of two species of snail shells, a curled greyish-green fern frond; in addition, 12 pieces of broken blue and white china, dark blue and bluish-tinted glass, bits of blue paper, blue matchbox drawer, blue silk ribbon, threads of blue wool, two blue tin bottle stoppers, etc. The artificial objects indicate a nearby camping ground (Calala). Bowers with such a wealth and variety of decorations are not often met with. It may be contrasted with a bower right in the scrub away from road and camping ground.

11/11/1923.—Bower "Alpha", Bola Creek:—On the platform: 18 flowers of *Billardiera scandens,* two sprigs of blue-violet flowers of *Dianella caerulea,* dry leaves of *Banksia serrata* and *Schizomeria ovata,* a dried pseudo bulb of the epiphytic orchid *Dendrobium tetragonum,* and several brown snail shells; but no artificial objects.

Remarkable for its abundance of flowers was:—

27/10/1923.—Bower "VV", a little above the mouth of Waterfall Creek, at the bottom of a small side gully. On platform: Up to 150, or so, flowers of *Billardiera scandens* (pale greenish-yellow), about a dozen blue-violet flowers of *Lobelia gibbosa,* several sprigs with blue-violet flowers and buds of *Dianella caerulea,* dry leaves of *Banksia serrata* and *Schizomeria ovata,* and finally blue-violet feathers of the Crimson Parrots; but no artificial decorations. When the bower was visited on the following morning at 7 o'clock, the Billardieras had been increased to about 200, forming a veritable carpet of green-yellow studded with the blue-violet flowers and feathers.

A rather unusual, interesting departure from the ordinary arrangement of the decorations on the bower platform may here also be mentioned.

11/11/1923.—"Bower "ZZ", Bola Creek. The bower structure itself showed no unusual features. The platform in front of the main entrance, made of stiff straws, was roughly rectangular, and about eleven inches wide. It was without any decorations, but its outer long edge was bordered by a straight length of bare branch, about an inch thick; a thinner piece, lying more aslant, bordered the smaller edge of the rectangle on the left side. On the outer side of the thicker branch the decorations were laid out: flowers of five different species, *Banksia* and *Schizomeria* leaves, snail shells, and blue Crimson Parrot feathers. It looked like a garden plot fenced off against the inner lawn (platform). A fortnight later the same arrangement still held good, but with a modification in so far, as there was now to be seen a single blue-violet feather placed to the right of the right front wall corner, while from the opposite wall corner, and at a right angle to it, extended a short straight row of decorations, viz., one *Billardiera* flower, several bits of blue paper, and a blue matchbox drawer; the remainder and bulk of the decorations were still in the "garden". Later, in the off-season, the bower became neglected and fell to pieces, and the bower ground was

grown over altogether. But on the 19th October, 1924, all the growth of ferns and native raspberry plants which had sprung up in the interval, was found removed and a new bower (N.B.5) had been erected in the same spot, and presumably by the same bird. The two branches of the previous year were still present; there was now, however, a third piece of branch lying parallel to the thick old branch, but several inches away from it, and fencing last year's open "garden" off against the scrub. In this garden there was now assembled in a fairly orderly manner a large collection of dry leaves of *Banksia serrata, B. aemula,* and of *Schizomeria ovata,* and only these leaves. All other decorations, flowers of *Billardiera, Dampiera, Dianella* and *Wahlenbergia* were on the lawn (platform), as well as snail shells, Cicada cases, cocoons, etc., but not one leaf among them. There was another novelty attached to the bower, a little "corduroy" track of short sticks, leading from the scrub at one side to the edge of the platform on the right. A week later the majority of the platform decorations had been shifted into the "garden" among the leaves. On the 30th November the bulk of the decorations was still in the "garden", while all that the platform showed were a few *Billardiera* flowers and blue-violet feathers, and a sprig of flowers and birds of the blue-violet *Stypandra caespitosa.* In the spring of 1925 the new bower was in a new place, some dozen yards or so from the old, but it entirely lacked anything unusual. Perhaps the bird was a different one. The interest in the two bowers described lies in the novel arrangement of the decorations and seems to point to a distinct sense of form and decorative effect. It is strongly reminiscent of the decorative arrangements of the Gardener Bower-bird (*Amblyornis inornatus*) of New Guinea, first described by Beccari. See also Dr. Colin C. Simson's account in the "Ibis" of July, 1907.

The foregoing examples may suffice. Decorations vary, of course, with the season of the year, the locality, etc., and there are all gradations from bowers with a very few ornaments only to such a one as described from the Upper Peach Trees.

Returning now to the brightness question, I will first quote some remarks of Sir J. H. Parsons (1924) on the subject. He quotes Newton as follows:—

> "It is to be noted that the most luminous of the prismatic colours are the yellow and orange. These affect the senses more strongly than all the rest together; and next to these in strength are the red and green. The blue compared to these is a faint and dark colour, and the indigo and violet are much darker and fainter, so that these compared with the stronger colours are little to be regarded."

Parsons then says:—

> "Apart from the change in colour, the most striking feature of the spectrum is the difference in brightness or luminosity of different parts. The brightest part is in the yellow at about the D line, the luminosity diminishing continuously on both sides to the extreme ends. The brightness varies with the intensity of the light, but if the intensity is increased beyond a certain point the colours also change in tone."

If, then, blue is of such low, or let me say relatively low, brightness value, and yet the Satin-bird shows such great preference for it, does it not necessarily follow that brightness or luminosity cannot be the deciding

factor in his choice, but that the blue and even more the blue-violet colours themselves form the attraction for him, and brightness is merely accidental?

In my own decoration list the only "blue" objects, apart from artificial ones, are flowers, some feathers, and a few berries. It is then interesting to note that among the flowers (and berries) there is not one 100% blue; they are all either violet-blues or blue-violets up to spectrum violet; the feathers of the Crimson Parrot also are blue-violet, the rest of the flowers are purples, with either violet or red dominating in the colour mixture.

The principal bright (or gay) object in most quotations given appears to be the blue Parrot feather; the rest of them are in my opinion of very poor value. Strange to say, except in some Australian quotations, flowers are hardly, if at all mentioned. And who has not heard of bright flowers? And the Satin-bird does collect flowers, even some bright ones. But they are collected for their particular colour value, not for their brightness; and there are many very bright flowers, oranges, lemon yellows, reds, whites, which he quite ignores. Unfortunately, I cannot go into any details here, as the subject would take up too much space. But my material could be made available to any one interested in this subject.

However, a few of the bright flowers which the Satin-bird deliberately ignores are: wild flowers: *Gompholobium pinnatum* (Ridgway: pale lemon-yellow, 23b); *Platylobium formosum* (17, cadmium yellow); *Pultenaea* spp., *Dillwynnia ericifolia*, and *Gompholobium grandiflorum* (all three: 19, light cadmium); *Bossiaea scolopendria* (21', wax yellow); *Hibbertia volubilis* (23', lemon-yellow); cultivated flowers: *Thunbergia Gibsoni* (11, orange chrome); two *Gazania* varieties (13, cadmium orange, and 17, cadmium yellow); *Eschscholtzia* spp. (15, orange, and 17, cadmium yellow). Some of these flowers, like the last-mentioned, are, indeed, outstandingly luminous, but the Satin-bird shows no interest in them, and thus himself disproves the assertion that he is attracted by bright objects.

Bright green leaves, and also dark shades of green, again are not used by him. His range is limited to certain greens, and to these he sticks. They will be found in the colour list of decorations. This applies also to any other decorations, if it is desired to ascertain their definite colour in accordance with Ridgway's Colour Standard (1912).

It has been said repeatedly that the Satin-bird selects his objects without any discrimination; in fact, anything would do him, any colour or form of object, but, as already indicated, such statements have no basis in fact. In this regard the following remarks are of interest.

Parsons (1924) writes: ". . . from evidence showing that one colour is markedly preferred to another we can infer that the colours are sensed as different colours, unless the preference can be ascribed to differences in brightness."

Well, it is just this sensing of different colours by the Satin-bird that I am out to prove, and it is for just that reason that brightness playing any part in the Satin-bird's choice had to be, and has been, eliminated, I think.

It had early aroused my attention that the Satin-bird did not only collect blue articles for his decorative purposes. There were other decorations in other colours, and they were not accidental, but recurring at different bowers. Mr. Neville Cayley gave me a clue on this point when I showed him a dry leaf of *Banksia serrata* from one of the bowers. You'll find that this matches the back of the female bird pretty well, he remarked.

At that time I had seen the female only at a distance, and was not acquainted with the details of her plumage pattern. So the remark of Mr. Cayley, though interesting, did not convey much to me. But it lingered in my mind, and in time it appeared to me that other decorations might well be matched with her plumage too. The colour of snail shells matching the primaries and tail, for example. It was, however, the acquisition of Ridgway's Colour Standard (1912), in the later part of 1922, which put my investigations at once on a surer basis, as it permitted me to compare the colours of the decorations directly with those of a female's skin. This, then, gradually opened a new vista. Did the male collect the female's colours with a purpose, or not? Well, much more material was needed to prove that.

In 1923 and 1924, I corresponded with Prof. Dr. Casey Wood, of Chicago, Ill., whose acquaintance I had made during the session of the Pan-Pacific Congress in Sydney, in April, 1923, and some of my rough notes on the Satin-bird's colour-sense were published by him later (Wood, 1925).

Unfortunately I lost the Colour Standard during field work. I think in 1924, and this, of course, impeded my work very much.

Now, what colours do make up the female Satin-bird's plumage pattern? Here, Gould's description (1848, 1865) may follow, and opposed to them Ridgway's colours, obtained from comparison with a female skin, will be shown. This, then, will permit comparison of the colours of the female with those of decorations in an easy and reliable manner.

Gould's description.	*Female skin : Ridgway's colours.*
Head and all the upper surface: greyish green;	head, crown: 41"",i, deep bluish-green and 29"",i, slate-blue; upper surface, neck: 21"",i, deep greyish olive, and 23",k, yellowish olive;
wings and tail: dark sulphur brown, the inner webs of the primaries being the darkest;	wing (gradating): 15,m, Brussels brown; 15'm, Prout's brown; 17,m, raw umber; 17',m, mummy brown; wing coverts: 15,m, Brussels brown; tail: 15,m, Brussels brown.
under surface containing the same tints as the upper, but very much lighter and with a wash of yellow;	under surface, from throat down, also under tail coverts: 21',k, dull citine; 21",i, ecru olive; 27,f, pale green yellow to 29,f, pale viridine yellow; leg coverts 17', yellow ochre.
each feather of the under surface also has a crescent-shaped mark of dark brown near the extremity giving the whole a scaly appearance;	crescentic marks on under surface (gradating): 17,m, raw umber; 17',m, mummy brown; 19,m, medal bronze.
irides: of a deeper blue than in the male, and with only an indication of the red ring;	iris colour: approximately 51, Bradley's blue; inner ring: approximately 69,b, Tyrian pink (like the male), or perhaps 69, Tyrian rose.
bill: dark horn colour.	bill: 17',m, mummy brown.

Note: I wish to insert here some remarks about the iris of the Satin-bird, chiefly the male (adult). Gould gives this as "a beautiful light blue", that of the immature male as "dark blue". From watching adult males at and near their bowers and elsewhere at close range in 1922 and later with Ridgway in hand, I thought 51,b, Amparo blue a fair approximation. With female birds, owing to their shyness, I have been less successful, as it is rather difficult to get close to them to get a satisfactory view. I consider, however, 51, Bradley's blue to meet Gould's "deeper blue than in the male".

In September, October, and November, 1939, at the bower-bird aviary in the Taronga Zoological Park, I was able to see "eye to eye" with an adult male and an immature male (bill like the adult male's, not dark brown like the female's). Both these males on these three occasions would fly up on the wire-netting time and again to take bits of violet-blue paper, which I pushed through the meshing, right from my fingers. By holding on to the bits, at which the birds would tug, I gained a few seconds each time of very close view of their eye colour. I also watched them on the ground close to the netting; and the female there also. I found my earlier determinations as to the adults pretty well confirmed. But the iris colour of the immature male did not agree with Gould's description of it, nor did it agree with either of the two adults, for it was a distinctly pale blue-violet, about 55,d, or 53,d, of Ridgway.

Now, from the colour definitions of the female's plumage, bill, and iris, two separate colour series, each with two subseries are obtained:—

(1) from 15, yellow orange (pure colour) to 29, green yellow, which may be subdivided as follows:—

(a) 15 and 17, resp. orange and cadmium-yellow; but these are only represented by dark shades, viz., orange browns and cadmium browns;

(b) 19, light cadmium yellow; but only represented by a dark shade, i.e., a dark orange citrine (19,m, medal bronze);
21, lemon chrome; 23, lemon yellow; 27, bright green yellow; 29, Neva green.

All the four pure colours occur in admixtures with white, black, or grey.

(2) (a) 51, Bradley's blue (approx.).

(b) 69,b, Tyrian pink, or 69, Tyrian rose-purples.

Intermediate between the two series: 41, a shade of benzol green.

It will now be of interest to learn whether these colours of the female can be matched by the colours of the decorative objects. I, therefore, submit a list of those decorations for which I have been able to obtain the correct colour values. Some of these determinations were made in 1922-1924; but a very considerable number were made only in 1938 and 1939, when all the old determinations were checked over as far as possible. In all the later day determinations I was most ably assisted by my wife.

Bower Decorations and Their Colours.

Flowers: (a) range blue-violet-purple.

Comesperma ericinum: 63, violet purple; *Dampiera stricta* (variable); 55,b, light blue-violet, 55, blue-violet, 55,i, deep blue-violet, 55,k, hyazinth blue; *Dianella caerulea* (variable): 55,d, pale blue-violet, 55', soft blue-violet, 57,b, light bluish-violet; bud: 59,b, light violet; berry: 59,k, dark

violet; *Elaeocarpus cyaneus*, berry: 51',m, alizarine blue; *Hardenbergia monophylla* (variable): 59,i, royal purple, 61', pleroma violet, 61',i, haematoxylon violet; *Ionidium filiforme*: 61', pleroma violet, 61,b, lavender violet; *Jacaranda mimosaefolia*: 59,d, pale violet; *Lobelia gibbosa*: 55, blue-violet; *Pätersonia sericea* (variable): 59, spectrum violet, 59,i, royal purple, 59,k, dark violet; *Prostanthera violacea*: 53,d, light amparo purple; *Ruellia australis*: 61,d, light hortense colour, 61,f, pale hortense colour; *Scaevola ramosissima* (varying): 61,f, pale hortense colour, centre: 61,b, hortense violet; *Solanum aviculare*: 61',b, lavender violet; *Stypandra caespitosa*: 53,i, smalt blue; *Thelymitra ixioides*: 57,b, light bluish-violet, and 59,b, light violet; *Viola betonicaefolia*: 61,d, light hortense violet, 61,b, hortense violet; *V. hederacea*: 57",i, deep dull bluish-violet; *Wahlenbergia gracilis*: 59,b, light violet, 59,d, pale violet;

Cultivated flowers (in tests): *Bougainvillea* (? *spectabilis*): 65, purple true; *Delphinium Ajacis*: 53,i, smalt blue; *Pelargonium* species: 67,b, mallow purple to 67, rhodamin purple, and 69,b, Tyrian pink to 69, Tyrian rose; *Plumbago* (? *capensis*): 53,i, smalt blue; *Wistaria* sp.: 61,b, hortense violet; *Cineraria* sp.: 59,m, blackish violet, *Matthiola* sp., single: 61,i, Rood's violet; double: 65,m, blackish purple; *Portulaca* sp.: 67,d, light mallow purple to 67,b, mallow purple;

(b) other colours (varying according to freshness):—

Billardiera scandens: 27,d, light-green yellow, and 31,d, light yellow-green; Acacias (all determinations made from fresh specimens): *A. binervata*, 23, lemon yellow; *A. floribunda* and *A. myrtifolia*, 23,d, picric yellow; *A. juniperina*: 23,d, barium yellow, and 25,f, sulphur yellow; *A. oxycedrus*: 23,b, pale lemon yellow, and 23,d, picric yellow; *A. suaveolens*: 23,f, Martius yellow, and 25,f, sulphur yellow; bud: 23, lemon yellow;

Dendrobium speciosum: 25',f, pale chalcedony yellow, 25,d, light chalcedony yellow, 25,b, chalcedony yellow;

Cultivated flowers (in tests): *Gazania* sp.: 21',f, ivory yellow; *Genista* sp.: 21, lemon chrome.

Leaves (dry only):—

Banksia aemula: 21',i, olive lake, 21",i, ecru olive, 23,i, pyrite yellow, 25",i, mignonette green; *B. integrifolia*: 23",b, reed yellow, 23",i, light yellow; *B. latifolia*: 17"',i, buffy brown (above), 17,k, antique brown, or 15,k, Sudan brown (below); *B. serrata*: 21,i, sulphine yellow, 21',i, olive lake, 21",i, ecru olive, 21", dark olive buff, 21"',b, deep olive buff, 23',i, yellow citrine, 25"',b, light grape green to 25"', grape green, 25"", vetiver green, etc.; *Loranthus* sp.: 21',k, dull citrine, 23",k, yellowish olive; *Schizomeria ovata*: 21",i, ecru olive, 23,i, pyrite yellow, 23',i, yellowish citrine, 23", olive yellow, etc.

Plants, or parts thereof:—

Clubmoss (*Lycopodium densum*), dry: 19",b, chamois; *Dendrobrium tetragonum*, dry pseudobulb: 19',k, buffy citrine, etc.; puff ball fungus: 17",k, Saccardo's umber; fruit of *Solanum aviculare*: 23', strontian yellow.

Feathers:—

Crimson Parrot (*Platycercus elegans*): 53*,m, Urania blue, 55, blue-violet shading to 55,m, dark aniline blue; Turquoise Parrot (*Neophema pulchella*): 43,d, calamine blue; White Cockatoo (*Cacatua galerita*): 25,d, pale greenish yellow, or 25,b, light greenish yellow; various feathers of Green Satin-bird; also small blue-violet tipped black of male (? moult); Masked Owl (*Tyto novaehollandiae*): 17',m, mummy brown; Boobook Owl

(*Ninox boobook*): 17,m, raw umber; Tawny Frogmouth (*Podargus strigoides*): 15",m, bister to 15',m, Prout's brown.

(Colours of artificial objects omitted):—

From the colour definitions of the decorative objects two separate colour series each with two subseries are once more obtained, viz.:—

(1) from 15, yellow-orange (pure colour) to 31 green-yellow, with two subdivisions:—

(a) 15, yellow-orange and 17, cadmium-yellow; but only dark shades of these two colours are represented, viz., orange-browns and cadmium browns.

(b) 19, light cadmium-yellow; but only represented by dark shades of this colour; viz., dark orange citrines (19,m, medal bronze, etc.);

21, lemon chrome, 23 lemon-yellow, 25 greenish-yellow, 27 light green-yellow;

29, Neva green, 31, yellow-green, viz.: 21 and 23 in full colours, tints and shades, 25 in full colour and tints, 27 to 31 in tints only;

(2) from 45, green-blue to 59, spectrum violet, and beyond to 69, purple, with two subdivisions, viz.:

(a) 45, cerulean blue (pure colour), 47 methyl blue, 49 spectrum blue, 51, Bradley's blue, 53, phenyl blue, 55, blue-violet, 57, bluish-violet, and 59, spectrum violet, either in full colour, shades, or tints;

(b) 61, amethyst violet, 63, violet purple, 65, purple (true), 67, rhodamine purple, 69, Tyrian rose, either in full colour, tints, or shades;

Intermediate between the two series: 43 Italian blue: a green-blue with a preponderance of green; only one instance.

Note re 45: only one instance recorded, i.e., 45",i, deep orient blue, in broken pieces of Bakelite ware. By the way, the male Satin-bird in his bill shows also 45, i.e., 45",m, dusky orient blue.

If now the two colour series of the female's plumage, etc., are placed in juxtaposition to the two colour series of the decorative objects, we obtain the picture shown in tables I and II (opposite) and respectively representing the two colour series.

If we now look at Table I, the outstanding feature is a division into two groups of colours: a brown, representing the wings, wing-coverts, tail, bill, and the crescentic markings on the underside of the female, 15 and 17; 19, which I have taken before in my subseries b, is a kind of intermediate; i.e., dark orange citrine; it also represents some of the crescentic marks. The second group, yellow-greens on the whole, represents the upper and underside of the female, 21-29, and, not contained in the female's plumage, 31. It is, by the way, interesting to note, that in the adult male's plumage the browns appear as black, and the yellow-greens as blue-violet.

Another striking feature is the correspondence of the colours of the female with those of the decorations. This becomes still more evident, if Ridgway's Colour Standard is opened and the colours are compared directly. If we take, for example, 17,m, raw umber, a dark cadmium brown in the female's plumage, we will find that this same colour also occurs among the

TABLE I.

Colour number	15	17	19	21	23	25	27	29	31
white									
tint f	.....	.....	.....	.....	D.	D. DG.	B. D.	B. D.	
„ d	.....	.....	.....	.....	D. DG.	D. DG. D.			D.
„ b	.....	.....	.....	DG.	D.	D. DG.			
full colour	.....	.....	.....	DG.	BG.	DG.			41
					D. DG.				
shade i	.....	DG.		BG.	D. DG.			BG.	BG.
			D.	DG.				cr.	cr.
„ k	D.	D. DG.	DG.	BG.	DG.				
				DG.					
„ m	B.	B. BG. B.							
	D.	D. DG.							
black									
	B: w., w.c., t.	w. w., c.m.	c.m. w., c.m., b.	un.s., up.s., n.	up.s., n.	un.s.		un.s.	

Explanation:—

B. female's plumage; BG. do. with grey admixture; D. decorative objects; DG. do. with grey admixture; b. = bill; c.m. crescentic marks on under side; cr. = crown; n. = neck; un.s. = under side; up.s. = upper side; w. = wing; w.c. = wing coverts; t= tail.

TABLE II.

Colour number	45	47	49	51	53	55	57	59	61	63	65	67	69
female (iris and inner ring)				*									*
decorative objects	*	*	*	*	*	*	*	*	*	*	*	*	*

decorations, but in addition in the latter also 17,k, and 17,i. These are, however, merely less black admixed shades than 17,m, and fall readily in the same colour scale. Similar examples could be given from among the yellow-greens, but the foregoing may suffice.

Table II does not, I think, require any special explanation, except to say that the colour range of the decorations is naturally much wider. Blues, violets, and violet-purples are the attractions for the male, and no distinction is in my experience made between the different tones.

A few remarks may here be made about some yellow-greens which, although they fall in the colour range 25 to 29 of Table I, are not collected by the Satin-bird. They comprise the leaves of a number of trees which are found growing in National Park in abundance. In the following I will give a few of them with their colours added. Species of Eucalyptus (f.i., 27',m, yew green, 29',m, dark cress-green, etc.); *Angophora lanceolata* (29',m, dark cress-green); Turpentine-tree, *Syncarpia laurifolia* (25',m, hellebore green, or 27',m, elm green); *Callicoma serratifolia* (25,m, calla green), and those of many others, as fig trees. They are, as will be seen, all dark tones (m). The reason is evident; the female's plumage does not show these dark shades. Leaf form cannot play any part in the selection; though rigidity may have some influence when it is combined with an acceptable colour. The leaves actually collected in general show this feature.

Emerald green and blue greens are general absentees at bowers.

White is never collected—e.g., white flowers—but may be seen in combination with an acceptable colour, when, of course, the latter forms the attraction: blue and white china. Also a proof that the bird is not concerned with brightness.

It is similar with black. Against this it may be urged that the male Satin-bird often paints the inner walls of his bower black. But there is a difference in this; it is not a collected object. And if the male decks the approaches (platform) to his playhouse in the colours of his mate, as the troubadours and knights of old used to deck themselves with the colours of their lady-loves, why should he not paint the walls of his house in his own colour black when it pleases him to do so. I recently read that a suggestion had been made that painting may be connected with the bird's liking for dark colours. I should like to see this substantiated; so far I have not been aware of any such liking of the bird for dark colours as such.

In the foregoing two colour series have been established, separated in the spectrum: a yellow to yellow-green and a blue to spectrum violet and purples beyond. It has also been shown that in these two series the colours of the female Satin-bird's exterior (plumage, bill, iris), when juxtaposed with the colours of the decorative objects, are well matched by these latter, and that colours which do not closely match those of the female are not represented among the decorations. Examples have, furthermore, been given of a number of flowers and leaves which, although falling in the yellow to yellow-green series (15 to 31) are not accepted by the male for his decorative purposes, obviously because they do not match the female's colours. This fact is thus an indirect confirmation of my contentions in that direction.

The conclusions I am then drawing from the evidence provided in the foregoing pages, crystallized in the two tables, is that the male Satin-bird collects for his decorative purposes, practically without exception, only such colours as can be matched by the colours of the female's exterior (plumage,

bill, iris), and that any other colours are disregarded. The evidence for these conclusions is based on many years of field observation records and tests at the aviaries of the Taronga Zoological Park.

Another conclusion which can safely be drawn from the evidence offered is that the male Satin-bird possesses indeed an extraordinarily and astonishingly fine colour sense which enables him to discriminate with apparent ease between different colours, and also, within one definite colour scale, between its different tints and shades.

Now, if the colour sense of the male Satin-bird is indeed so perfectly developed as has just been claimed, that is that he is not only able to perceive correctly the colours of the female—in itself a rather extraordinary thing—but in turn to go and select decorations for his bower in precisely the same colours, a psychological fact of great importance, then we must assume that the physical basis for such an acute colour sense is also present in his visual organs. He must, therefore, possess a colour vision, which in its wide range compares closely with that of man.

What then has science to say on this point? The answer will presently be given in a number of quotations.

But before this I wish to insert here a paragraph on the

Frequency at bowers of certain decorations.

Blue-violet decorations are by no means predominant over those of other colours at the Satin-bird's bower. To demonstrate this fact I submit here a list of eight principal natural objects found on 274 bowers, on as many occasions, visited from September, 1922 to April, 1926, both months inclusive; but exclusive of those months in which bowers were not visited and exclusive also of those months in which none of the eight principal decorations was found. This leaves 34 productive months out of 44.

	found in:			
Yellow—yellow-green subseries:				
Billardiera scandens	226	cases	in 28	months
various *Acacia* species ..	37	„	„ 14	„
(dry) *Banksia serrata* leaves ..	123	„	„ 26	„
Brown subseries:				
species of snail shells ..	118	„	„ 29	„
	(504	cases)		
Blue to violet subseries:				
Dampiera stricta	89	cases	„ 19	„
Dianella caerulea	42	„	„ 9	„
Lobelia gibbosa	71	„	„ 14	„
Crimson Parrot's feathers	98	„	„ 27	„
	(300	cases)		

So as to make the figures comparable only such bowers were taken into consideration in which at least one of the above eight decorations was present. In this instance one mark was made against bowers visited, and one against that decoration. If more than one of the latter was present each received a mark, but there would always be only one mark against the bower. As regards flowers, attention may be drawn to the fact that, with the exception of *Billardiera scandens*, which flowers practically all the

year round, they are naturally limited to a certain season of the year, the four other species above-mentioned, roughly to about May or June to December. Both, absolutely and relatively, *Billardiera scandens* is the most frequent decorative object.

Colour Vision of Birds.

C. Hess (1914) wrote (translated):—

"If a diurnal bird, for example a fowl, is placed before a strong spectrum [thrown on a horizontal black surface] over which grains of rice have been scattered, it will pick the grains just so far towards the red end as they are visible for our own eye, and in addition take the yellow and green grains, but will leave untouched the green-blue, blue, and violet ones, though these are well visible for us."

He gives as the reason for this that microscopical examination of the retina of the above-mentioned birds disclosed the fact that the cones on its outer side contain yellow or red, so-called oil globules, which absorb the short wave-lengths of the light, so that only the long wave-lengths reach the retina proper. Diurnal birds were thus supposed to see the world of colours in the same way as we would, if we were looking through reddish-yellow glasses.

I have gone through a good deal of the literature on this subject, but to my surprise found that this theory has, with a very few exceptions, been generally accepted.

I became acquainted with Hess's views towards the end of 1924. Naturally the assertion that diurnal birds could not see blue made me sit up at first; for four years of field observations had taught me that the Satin-bird had an especially keen eye for blue and violet. Yet here it was claimed that he could not see these colours at all, except as perhaps something drab and grey. Surely there was something wrong and inconsistent in the assertion that birds, these "exquisitely poised" creatures of air and light, should have been so limited by nature in their most vital sensory organ, the eye, that they were able to see only half the world in its natural colours. That seemed incredible, and I was not at all convinced.

Now, Hess's experiments were made only with such diurnal birds as fowls and pigeons; but it does not necessarily follow that what holds good for fowls and pigeons must hold good for all other diurnal birds; for example, a bird "widely remote in the tree of avian life", like the Satin-bird. Have the visual elements of any such birds also been examined? I do not think so, unless it has been done quite recently. To extend then the deductions made from the results obtained with fowls and pigeons to all diurnal birds seems to me a generalization which lacks any scientific caution and offers no proofs in its support. It is said that only yellow and red oil globules occur in diurnal birds. But why no blue or green? The latter, I think, have been ascertained in the rods of frogs. Colourless oil globules, which do not obstruct blue light to reach the retina, occur in fishes and amphibia; why not in birds? Hess does not seem even to have considered the possibility. There are so many different modes of life in the bird world, there are great differences in the environment they live in, etc. A swift possesses a different wing from that of a sparrow, and an albatross from that of a quail, and nature has provided them with what is suitable for the mode of life of each. Why then should this not be equally applicable to the vital visual elements of birds, and these be adapted to their different needs?

Let us now look at the matter from another angle. Assuming that European domestic pigeons were used in Hess's experiments. They, like their relatives, the wild doves, are principally seed eaters and ground feeders; but I doubt very much that in their search for food they would come across, or in captivity be fed with, blue seeds. No association would, therefore, be formed by these birds with blue as a food, a seed, and the blue grain in the experiment would thus be ignored, as indeed it was.

The experiment, therefore, does not by any means prove that diurnal birds, including these pigeons, cannot see blue.

But there are other pigeons, to mention only the large family of the Carpophagidae, the Fruit Pigeons, which are neither seed eaters, nor ground feeders, but live principally on fleshy fruits, berries, and the like in the trees. These fruits are of all colours, including blue; for example, those of the widespread genus *Elaeocarpus* (from India right through into the Pacific, and including Australia). It is well known that fruit pigeons, parrots and other frugivorous birds (including the Satin-bird), readily eat these fruits. Only the fleshy, succulent outer part of the fruit, or drupe, is consumed by birds, while the hard inner endocarp, or seed, passes through and out of the body undigested. Now, these birds must be able to distinguish the green, unripe fruit, which they pass by, from the blue, ripe one, which they consume. Consequently they must be able to discriminate between the two colours, green and blue, that is see and sense them.

It has been suggested that food tests might be made with the Satin-bird in some manner similar to Hess's. But what could they prove? The Satin-bird is principally, though not solely, a fruit-eater, and will eat any ripe, fleshy, pulpy, luscious fruit, whether its colour is red, orange, yellow, green, blue, violet, purple, black, or white. Examples for any of these colours could be given. And he is quite well aware what is ripe and what not. Any experiments made in that direction would, therefore, be quite futile and to no useful purpose, as they would disclose nothing in regard to the bird's colour sense that was not already known from field observation. Besides, although the Satin-bird disregards certain colours, like red, orange, white, etc., as decorations for his bower, he certainly does not reject them as a food. Which shows, again, that he knows how to discriminate.

What has been said about the Satin-bird may, no doubt, be applicable to many other birds.

After this somewhat lengthy "aside" little more need be said in regard to Hess's theory that diurnal birds cannot see blue. I do not consider that this theory has been proved, and that it has any general validity, or that it will in any way affect my own conclusions.

I have developed my own ideas on the colour sense of the bird and stated them. And I feel confident that the adult male Satin-bird possesses the colour vision and concomitant colour sense assigned to him. It is then only natural and logical to add that the same colour vision must also be assigned to the immature male and the female of the species.

The positive, physical proof of the Satin-bird's unimpaired colour vision can only be produced by dissection of the bird's eye, but that, not being an anatomist, I cannot undertake.

I recently came across a paper on the colour vision of the Satin-bird by T. C. S. Morrison-Scott (1937). This author made a variety of tests with a large number of colours, also illumination and other special tests, which were of considerable interest to me, since in most instances they

confirm my own views. It would take up too much space to go into details here, so I shall confine myself to a remark or two.

Morrison-Scott distinguishes two colour ranges, a yellow and a blue, both of which readily fall within my own two colour series; but both of his two ranges are much too limited, and that at either end, so that the essential browns are entirely absent, as well as all violet purples and blue-violets; the violet-blues only remaining, etc. Otherwise his results are very satisfactory.

Finally, it may be noted that Hugh R. Cott (1940), says that more recent reseach has established the view that diurnal birds have the capacity for distinguishing between lights of different wave-lengths. If that is so, then my views on the colour vision of diurnal birds, and especially that of the Satin-bird, have been completely verified.

A few words may now be added about the "aesthetic" side of the Satin-bird's bower-building and decorative propensities, as these have been frequently referred to by various writers.

Darwin (1871) first drew attention to this matter when he ascribed a "taste for the beautiful" to bower-birds in general, and the Satin-bird in particular. In another place he remarks that "the playing passages of bower-birds are tastefully ornamented with gaily-coloured objects; and this shows that they must receive some kind of pleasure from the sight of such things". The accent is on the gayness or brightness of the objects, which intimates that the pleasure is purely sensuous, and in no way differs from that of a savage who delights in putting a piece of bright or gaudy cloth around his loins. This could hardly be called an aesthetic feeling in the true sense of the word, as that requires a cultured mind, which is capable of appreciating what is beautiful in nature, art, etc., and is not usually attributed to animals. However, I have not claimed that the Satin-bird finds pleasure in bright things.

Many explanations and interpretations of the Satin-bird's habits of assembling "bright", or at any rate coloured, objects at his bower, have been offered, but on the whole they do not seem in any way to improve on Darwin's views. For instance, quite recently they were described as "a blend between art gallery and museum" (J. Huxley, 1940). But that entirely misses the essential point, as will be apparent from what has been said earlier in this paper.

A French writer, Remy de Gourmont (1906-[1922]) wrote with reference to the Satin-bird and Gardener Bower-bird (*Amblyornis inornatus*) from a different point of view, as follows:—

"People search for the 'origin of art'; there you have it in the sexual game of a bird. Our aesthetic manifestations are but a development of the same instinct to please, which, in one species, over-excites the male, in another moves the female. If there is a surplus, it will be spent aimlessly, for pure pleasure: that is human art; its origin is that of the art of birds and insects." And:—

"The grave fact is the gathering of the first flower. The useful fact explains animality; the useless fact explains man. Now it is of capital importance to show that the useless fact is not peculiar to man alone."

De Gourmont's explanation is interesting and rather novel in regard to what he has to say about the origin of art. What he apparently drives at is that on divergent lines of evolution a mind has been developed in

birds, or certain groups of birds, which is only qualitatively different from man's. This mind would, in the first instance, owe its functioning to unimpaired vision similar to that of man; and, this being accepted, there should be no special reason why a bird—say the Satin-bird—could not experience similar sensations to those of man. For "there is no reflection, contemplative thought, or conception without perception", just as "there is no perception without sensory presentation" (Parsons, 1927), that is the psychological event in the brain is dependent on the physiological event at the visual sensory receptor, the retina.

If we look at the matter from this point of view, it does not perhaps matter very much whether we call the sensation derived from the sight of bright things sensuous pleasure, or place it on a higher plane and call it aesthetic. But that is not all; the important point is that perception is followed by contemplative thought, and that by conception, viz., the generation of an idea by the mind, which in turn, to give a concrete example, the Satin-bird, produces a tangible fact, the erection of his bower or playhouse. For this can hardly be thought of otherwise than premeditated and planned. In other words, an intelligent mind has been at work to create it, and it is the outward expression of this mind. If this playhouse is subsequently decorated with objects which please the bird, owing to their particular colours, then is this only another way by which the bird shows its ability to transfer his decorative ideas into visible effect.

In regard to the Satin-bird, it has previously been shown that his decorations are not collected for the sake of their brightness, but for their colours. There is no doubt about that; also that he derives pleasure from, and is stimulated by, these colours, in particular the blue-violet. But the main reason for selecting certain well-defined colours has again an idea, a meaning, at its back: they represent the insignia, so to speak, of his female mate. The presence at the bower of objects bearing her colours is then not so much for the purpose of attracting the female, but for his own stimulation; they act on him in the way of an aphrodisiac. In the following paragraph I will give an example of how the blue-violet colour affects the Satin-bird.

On the 6th of June of this year—note the date—I visited the bower-bird aviary in Taronga Park. There was in it an unattended bower without any decorations. Present in the aviary were a blue male in not yet complete, though far advanced new plumage. He was the owner of the bower; there were three immature green males, each with a dark spot here and there, the first faint signs of plumage change, and there were finally four green females. All these birds on my arrival sat quietly in the small trees, or flew to and fro, to settle down again. In a little while I introduced a number of little bits of blue-violet paper through the wire-netting into the aviary. Immediately the quiet scene changed as by magic, and great excitement prevailed all round. The blue male, after collecting what he could get of the blue papers, repaired with them to the bower, a female slipped inside it, and a performance began forthwith. The three immature males, each with a bill full of blue papers, having no bower, flew into the small, bushy trees near the back wall, settled on the most nearly horizontal branches, and, still holding the blue papers in their bills, began to perform too. Each had a female attendant, who sat a little higher up on another branch. This performing, in all four instances, lasted with only slight interruptions for 3½ hours. A very entertaining afternoon. A similar scene with the same eight birds was witnessed on the 13th of July.

But to resume the narrative. The female-coloured objects also play a part in the "display". As it does not appear to be the purpose of the male Satin-bird to display his finery before the admiring female, to attract her, I think it better to call this performance a rite or ceremonial, evolved by the mind of the bird, and culminating in what could be called a kind of apotheosis of the female. The decorations in this instance would be merely requisites of the ceremony, though not without some significance in the proceedings. It may be said here that the female throughout the performance remains entirely passive. All the same, the proceedings must impart to her a certain, if unconscious, stimulus, which would in turn be effective in bringing to maturation the physiological changes going on in her body, and ultimately resulting in ovulation.

The whole ceremonial, with the posturing of the male as the dominant feature is then, in the breeding season, and presumably also in some preparatory stages before its actual beginning, entirely bound up with the reproductive cycle of the species, and thus of great physiological importance and significance. Sexual selection, as postulated by Darwin (1871), is evidently not involved here.

To show the great intensity of the male Satin-bird during a short and rather unique performance in the bower-bird aviary at Taronga Park on the 13th October, 1939, i.e., in the breeding season, the following extract from my diary may be inserted here:—

Blue male on the platform in front of the bower; female arrives and takes up her position inside the bower; the male now faces her. Hardly any of the usual performance attitudes, movements, and accompanying calls have occurred, when the male abruptly steps to the left side of the bower entrance, and, now at a right angle to her, faces right away from her. There he remains for a while, perfectly motionless and rigid. His shining, sleek body is extended, his neck craned to the utmost—at first, then slowly twisted upward and round to such a degree that I can see the eye on the other, right side of his face. Entranced, transfixed, he stares into the void. No feather is raised, no wing is flicked up, the tail is neither bent down nor curved. Nothing moves. It is a singular, strange sight. Now he relaxes; the trance is over. The female flies away, but he remains on the platform, apparently quite oblivious whether she is still present or not. Then he steps to the right side of the bower entrance, where he is seen, head slightly bent down, and again perfectly motionless, standing as in deep meditation, for many minutes. I try to divert his attention, but he takes no notice. At long last he relaxes once more, and then makes off. What had been going on in his mind? Who knows!

The following two quotations are here of especial interest and importance:—

F. H. A. Marshall (1929) wrote: ". . . there is a strong presumption that sexual posturing in birds has a definite physiological significance in that it exercises a stimulating influence upon the anterior lobe of the pituitary, thereby causing it to secrete in greater quantity and so bring about those ovarian processes which result in egg-laying."

In a later, exhaustive paper (1936), on the "Sexual Periodicity and the Causes Which Determine It", the same author writes:—

"We may conclude, then, that in all the higher animals sexual periodicity while conditioned by the environment, is regulated in its successive phases by the combined integrative action of the nervous and

endocrine systems. The primary periodicity is a function of the gonad, the anterior pituitary acting as a regulator, and the internal rhythm is adjusted to the environment by the latter acting on the pituitary, partly or entirely, through the intermediation of the nervous system. . . ."

The rôle of the pituitary in connection with such sexual manifestations as posturing during display or ceremonial is thus apparently a factor of outstanding importance.

In the earlier pages of this paper it has been shown that bowers are erected by the Satin-bird in all months of the year. I mentioned among these one at Burunda Creek at as early a date as the 27th April, 1924 (it lasted till the 30th December). We may rightfully include that, and similar cases in May, June, etc., among bowers erected by the male as a kind of territorial signal. If we now include these latter among the aforementioned preparatory stages of the reproductive period, we have an explanation for the erection of early bowers holding good from late April onwards. We have, however, still to account for the months from January up to April.

Now along a certain river flat in National Park and opposite it there were in consecutive years always new bowers found erected from about mid-February to mid-March. During this time Satin-birds were always about there. I visited the locality in every year from 1921 to 1926, and there were bowers on either one or the other side of the river. On the flat I am here specially referring to anything up to twelve or more birds were present on a particular day. They included blue males, immature males in advanced plumage change, females, and young green birds of either sex. Performing was going on everywhere among the older birds, but, strange to say, the bower was in all these years hardly ever resorted to for that purpose. How is this to be explained? The first reason for their presence on the flat was, of course, the ripening of some fruit in the locality, for when this gave out, the birds were seen no more. The interesting part was, however, the very vigorous and intense performing at that time of the year, and that only in the trees. The actual players were always in pairs, an active male, a passive female. It could hardly be called a communal gathering, as may sometimes be observed with these birds, since there was seen no chasing in and around the bower, etc. Had it perhaps something to do with the approaching elevation of the mature males to full rank? It is difficult to say. The only positive thing is that the male birds had carried their ceremonial past the close of the breeding season in December into the off-time of the year. To satisfy their aesthetic needs? Hardly, for there was no scope for that in the trees. The only explanation left then is their love for the ceremonial itself without any direct reference to sex matters.

New bowers in January. On a river flat a new bower was found late in January, 1924, replacing one newly-erected in mid-December. On the second of March I watched thereabouts a very young bird in a tree being at intervals fed by its mother. Evidently, for one reason or another, a late brood had been reared there, and this accounted for the late bower in January. It may hold good likewise in other instances.

The habit of giving full dress performances in trees is not as rare as may be thought. I do not, however, remember having ever seen any reference being made to it in the literature.

I have not so far mentioned that the female Satin-bird does also build

a somewhat more primitive bower than that of the male, though only using it "prior to and during nidification". I consider this action as merely imitative of that of the male. It seems, however, to throw an interesting sidelight on her possible awareness in some way of the part she plays in the reproductive cycle. The sexual stimulation the male receives from posturing in the ceremonial in her presence no doubt reacts on her in a similar way. Mutual stimulation is thus not only important psychologically, but must exercise a decisive influence on her reproductive organs.

As Mr. P. A. Gilbert has done all the pioneering work as regards the female, I can do no better than refer to his interesting papers (1928, 1940) on the subject.

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REVIEWS.

"Furred Animals of Australia." By Ellis Troughton, C.M.Z.S. Illustrated in natural colours, by Neville W. Cayley, F.R.Z.S. Angus & Robertson, Sydney, 1941. Price, 14/6.

It is a trite saying to describe a book as "filling a long-felt want", but no better one could be applied to this handsome and comprehensive work.

Australia was described by Dr. W. K. Gregory, one of America's leading biologists, as a "land of living fossils" in reference to its preponderating fauna of Monotremes and Marsupials which, with a few American exceptions, are found outside of Australia only as fossil remains.

Mr. Troughton, Mammalogist to the Australian Museum, presents to us a most comprehensive description of every known Australian "furred" animal, not only of the egg-laying Monotremes, and the Marsupials with their young produced in embryo and nourished in a pouch, but all the placental mammals such as Rats, Mice, Bats, Seals and other genera which have more or less world-wide distribution. The animals are grouped according to their family characteristics, structure and habits, commencing with the egg-laying Monotremes, followed by the Marsupial-mice and Marsupial-rats. Then come the carnivorous Native cats, the Tasmanian Devil and Tiger. The Marsupial Anteater and Mole are succeeded by the Bandicoots, while the Possums, Koala, Wombats and Kangaroos follow in detail, concluding the Marsupial Group. The placental Mammals, Dingo, Whales, Seals, Dugong, Rats, Mice and Bats make an imposing list of this great second group.

Preceding and following the classified lists are extremely interesting notes on the early discoveries of Australian animals, their economic uses, conservation, and an appeal to Australians to preserve their natural heritage.

By giving a general sketch of the family characteristics of each group, Mr. Troughton avoids much unnecessary repetition, and enables the reader to realise the sphere in natural economics occupied by the family in question. The description of each species is generally brief, consisting mostly in detail of the features differentiating one individual species from another, but the distribution, life-histories and habits where known are dealt with at commendable length. Only in one particular an improvement might be suggested, and that is a reference to the relative or maximum recorded size of each species.

The illustrations by Cayley are for the greater part strikingly life-like, and in this particular the Kangaroos with their varied coloration, the Tasmanian Devil with its snarling and offensive attitude, and the Thylacine or Tasmanian Wolf, with its curious thick kangaroo-like tail may be specially mentioned. The difficulty confronting the artist in the case of the small Marsupial Mice and the non-Marsupial Rats and Mice can be easily appreciated, where the specific differences of colour, measurements of ears, tail, etc., are not easily emphasised in the small coloured figures, ten or eleven of which may be illustrated on one page. Of these coloured figures there are 170, or nearly one-half of the species and subspecies listed, 400 in number. Never before has such an array of coloured figures of Australian animals been placed within the reach of everyone. Such publications as John Gould's Monographs are only for the rich or for reference libraries, and the handbooks by Lucas and Le Souef or Le Souef and Burrell depict the animals only from photographs of living examples or mounted skins in

museums. In most instances Cayley has given the animal a characteristic or natural background of tree, foliage, rock or other surrounding.

Both author and artist are to be congratulated upon the production of a book which, entailing much arduous labour, is yet published at a very low price.—A.F.B.H.

Sailor Men's Ghosts. By Malcolm Uren. Robertson & Mullens, Melbourne. 1940. 9/-.

Coast of Adventure. By Charles Barrett. Robertson & Mullens, Melbourne. 1941. 9/-.

The islands of Australia, almost countless in number, are full of interest to the naturalist, the anthropologist, and the historian. Every group, and many individual islets of some groups, carry a message from Nature's storehouse, from the varied repositories of native art, culture or legend, or from the records of the early adventurers in search of the Great South Land.

Charles Barrett is already well known as a writer about birds, animals and reptiles of our Continent, and in his latest work he tells of his visits to the fascinating islands of the north—those facing Torres Strait and the Gulf of Carpentaria—on some parts of which he claims to be the first white naturalist to set foot. Every spot yielded material in the way of new species of ants, lizards, or shells, while his accounts of the weird rock paintings must fill the average ethnologist with envy. In what only claims to be a narrative of adventure, spiced with the constantly recurring dangers from storms, "shovel-nosed" spears, and other fearsome risks to which he was exposed, the author has a most tantalising way of suggesting the finding of a new shell or animal, without giving it a description close enough for subsequent identification by other naturalists visiting the same places. One hopes that the full results of his expeditions will some day be published in a scientific journal. Every island or port visited is identified with the records of the early voyagers, from whose diaries many quaint and interesting extracts are included in the narrative. The illustrations from his own photographs depict many curious examples of native art, while the chief picture of interest to naturalists is one of the Banded Anteater, or Numbat of the aborigines.

Malcolm Uren is not so prolific a writer in our field as Barrett, nor does he pretend to know anything about natural history as a science. His book is primarily and chiefly historical of the fate of a Dutch expedition, wrecked on the islands known as Houtman's Abrolhos. Incidentally to this narrative, mostly translated from old Dutch records, Uren adds a vivid description of the reefs and their inhabitants, the sea birds, enough to make one long to pay a visit to those celebrated haunts of the Tern and Osprey.

Both of the above books should be in the library of every naturalist.—A.F.B.H.

"Seashore, Swamp and Bush." By Ada Jackson. Robertson & Mullens, Melbourne, 1941. Price, 7/6.

Under the pen-name of Ajax, the author of the above work (Mrs. C. W. Fawcett), is a well-known writer of natural history articles, couched in a popular and often humorous vein. Her present work contains brightly written and informative articles on the various objects met with on the seashore, in the bush, and the swamps. She takes the reader over the beaches where her own hunting has been carried on, and describes the starfish, sea-eggs, molluscs and fishes found washed up after storms, and illustrates many with her own quaint little sketches. Frogs, planarians, insects and

oysters alike form objects upon which her gay fancy paints living pictures, and her poetic instinct clothes them with humorous verse. Many fine photographs add attraction to a volume which should find appreciation amongst the youthful seeker after information, while the adult scientist will find much to amuse in the way the authoress handles her "subjects."—A.F.B.H.

"SHARKS AND RAYS OF AUSTRALIA AND NEW ZEALAND."

Presentation to His Majesty the King.

His Excellency, the Governor-General (Lord Gowrie), having intimated that His Majesty the King would be glad to accept a copy of Mr. Whitley's book, "Sharks and Rays of Australia and New Zealand", a copy of the work was forwarded through His Excellency, the Governor of New South Wales (The Lord Wakehurst), Patron of the Society, and the following correspondence has been received.

"Government House,
SYDNEY,
6th June, 1941.

Dear Sir,—

With reference to your letter of the 27th December, 1940, forwarding under separate cover a copy of Mr. Whitley's book, "Sharks and Rays of Australia and New Zealand", for transmission to His Majesty, I now have pleasure in forwarding copy of a letter from the Private Secretary to the King, received by His Excellency the Governor-General, in which it is asked that His Majesty's thanks be conveyed to the author.

Yours faithfully,
(Sgd.) L. A. ROBB,
Official Secretary.

T. Iredale, Esq.,
Hon. Secretary,
Royal Zoological Society,
28 Martin Place, Sydney."

"Buckingham Palace,
29th April, 1941.

My Dear Governor-General,—

I have received and laid before The King, the copy of "Sharks and Rays of Australia and New Zealand", which you forwarded with your letter of January 11th.

His Majesty has been graciously pleased to accept this book and asks if you will be good enough to convey an expression of his thanks to the author, Mr. G. P. Whitley.

Yours sincerely,
(Sgd.) A. H. L. HARDINGE.

His Excellency,
The Governor-General of Australia,
Government House,
CANBERRA."

Note: The second Part of Mr. Whitley's work is in a forward state of preparation, and will probably be published about the middle of 1942.

A LANTERN FISH FROM MACQUARIE ISLAND.

By G. P. Whitley.

(Contribution from the Australian Museum.)

Family Myctophidae.

Genus Myctophum Rafinesque, 1810, *sensu lato.*

Myctophum anderssoni Lonnberg, 1905.

Myctophum anderssoni Lonnberg, Zool. Anzeiger, xxviii., April 25, 1905, p. 763; and Wiss. Ergeb. Schwed. Südpolar. Exped., v., 6, 1905, p. 61. [N.E. of Falkland Iss. South Atlantic Ocean], 49 deg. 56 min. S. Lat. x 49 deg. 56 min. W. Long. *Id.* Brauer, Wiss. Ergeb. Deutsch. Tiefsee Exped. Valdivia, xv., 1, 1906, pp. 161 and 172, fig. 84. *Id.* Parr, Bull. Bingh.-Oceanogr. Coll., iii., 3, 1928, p. 58. *Id.* Chapman, Proc. U.S. Nat. Mus., lxxxvi., 1939, pp. 526-7.

Two small specimens of this South Atlantic species were found in The Australian Museum amongst some unregistered and unidentified material from Macquarie Island. They were originally obtained by the Australian Antarctic Expedition, but were not listed in Waite's 1916 report and constitute a new record for the little-known fauna of Macquarie Island.

The larger example has the following characters: D. 12? A. 16? Head (10 mm.) 3.4, depth (8) 4.2 in standard length (34). Eye (4) 2.5, snout (2) 5, interorbital (3) 3.3 in head.

Snout rather pointed. Eye subcircular, non-telescopic, lens central. Antorbital organ of moderate size but ill-defined. Upper jaw with symphysial notch. Posterior end of maxillary broadened, reaching little behind eye.

Photophores without black dividing septum. None above 1.lat. Pol absent. Op. 1; PVO 2 or 3; PLO. absent; PO. 5, VLO. absent; VO. 4; SAO. absent; 2 anterior AO. elevated, plus 13, in a single, continuous group; 2 Prc. Some of the lateral photophores may be missing through loss of scales.

Scales cycloid. Apparently no luminous scales. Squamation deciduous. No supra- or infracaudal luminous plates.

PROPOSED DESTRUCTION OF SEALS IN VICTORIAN WATERS.

The fishermen of Western Port, Victoria, agitated for the destruction of Seals on the ground that they damaged their nets and ate 40 lb. of fish each *per diem.* The number thus disporting themselves in Western Port was estimated at 100,000. The Chief Secretary of Victoria at first announced that he would not allow any Seals to be killed, but later he reversed his decision. The Field Naturalists' Club of Victoria and the Royal Zoological Society of New South Wales have both entered strong protests against this later decision, but the Minister states that he will proceed to call for tenders to destroy 1,000 Seals under stringent conditions. It is hoped that the conditions will be such as to deter anyone from tendering.—A.F.B.H.

Fig. 4. Mountain Trout, *Galaxias bongbong*. Lectotype, Bong Bong, New South Wales.

Fig. 19. Rough Squirrel Fish, *Holotrachys oligolepis*. Holotype, Western Australia.

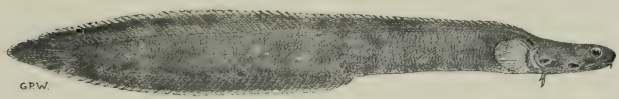


Fig. 26. Ethiopian, *Notograptus gregoryi*. Holotype, Shark's Bay, Western Australia.

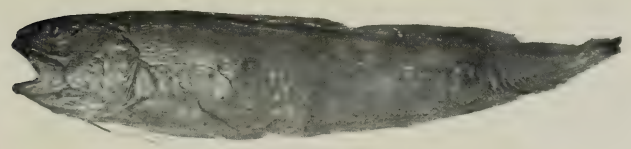


Fig. 28. Australian Tusk, *Dannevigia tusca*. Holotype, Western Australia.

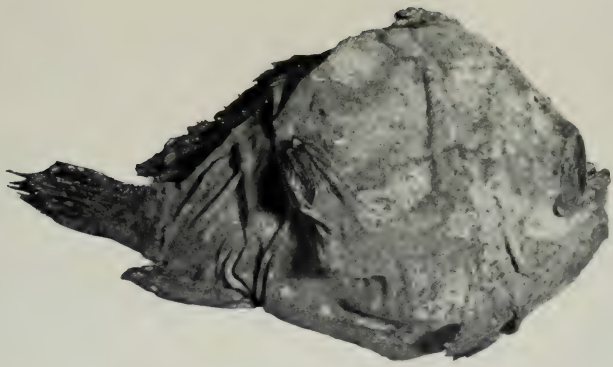


Fig. 29. Baggy Angler Fish, *Lophiocharon goramensis*. Off Cairns, Queensland.

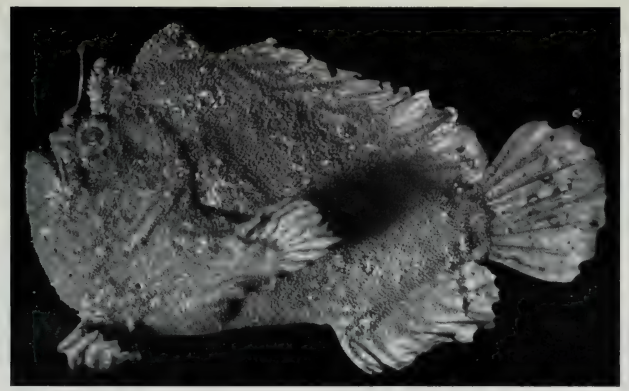
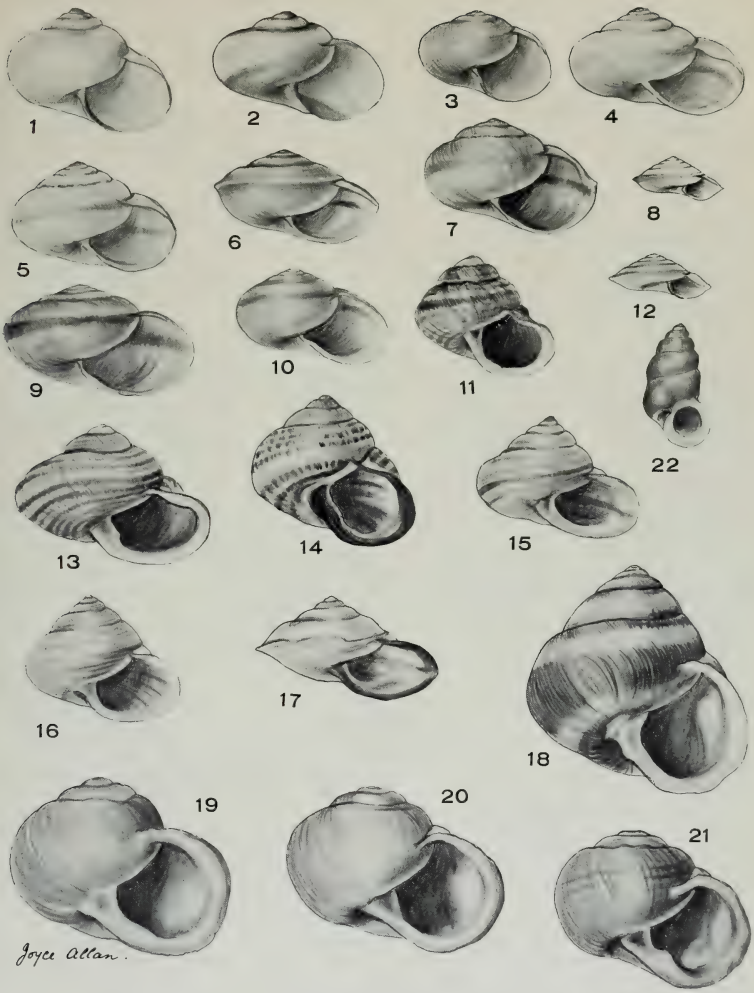
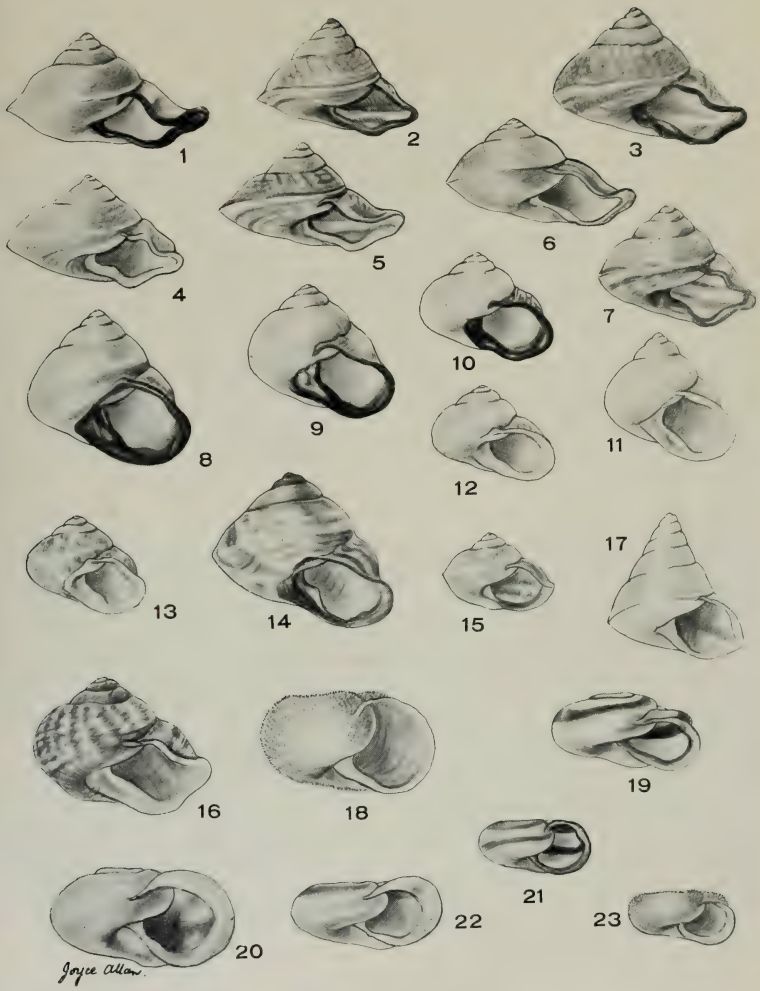


Fig. 30. Rough Angler Fish, *Antennarius asper*. Murray Island, Queensland.



PAPUAN LAND MOLLUSCA.



Papuan Land Mollusca.

Blue Male Satin Bower-Bird, picking up blue paper.

Two bowers with walls joined. Top-hamper on each wall.

Biology of Satin Bower-Bird.

Photographs by E. Nubling.

Royal Zoological Society of New South Wales.

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Benefactor	„ „ £500 „ „ „ „
Endowment Member	„ „ £1,000 „ „ „ „

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Australian Zoological Handbooks.

The Fishes of Australia, Part I, "Sharks and Rays", by Gilbert P. Whitley, F.R.Z.S. 280 pp., and over 300 illustrations. Price, 7/6. Postage: Australia, 5½d. British Possessions, 7½d. Foreign, 11½d.

(Note: "The Fishes and Fish-like Animals of New South Wales" is out of print.)

A Monograph of the Australian Loricates, by Tom Iredale and A. F. Basset Hull. 168 + xiii. pp., 21 plates and portrait. Price, 5/-. Postage: Australia, 5½d. British Possessions, 9½d. Foreign, 1/6½d.

Bibliography of Australian Entomology, 1775-1930, by Anthony Musgrave, F.E.S. 380 + viii. pp. Price, 10/-. Postage: Australia, 6½d. British Possessions, 9½d. Foreign, 1/6½d.

Australian Spiders and Their Allies, by W. W. Froggatt, F.R.Z.S. Price, 2/6. Postage: Australia, 1½d. British Possessions, 2½d. Foreign, 3½d.

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